Lucent Technologies
Bell Labs Innovations



DDM-2000 OC-12 Multiplexer Release 7.0

User/Service Manual — Volume I

363-206-295
Issue 1
December 1997

Copyright© 1997 Lucent Technologies, All Rights Reserved.

This material is protected by the copyright laws of the United States and other countries. It may not be reproduced, distributed or altered in any fashion by any entity, including other Lucent Technologies Business Units or Divisions, without the expressed written consent of the Customer Training and Information Products organization.

For permission to reproduce or distribute, please contact:

Product Development Manager 1-888-LTINFO6 (1-888-584-6366).

Notice

Every effort was made to ensure that the information in this document was complete and accurate at the time of printing. However, information is subject to change.

Mandatory Customer Information

Interference Information: Part 15 of Federal Communications Commission (FCC) Rules.

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residence is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Security Statement

In rare instances, unauthorized individuals make connections to the telecommunications network through the use of remote access features.
In such event, applicable tariffs require that the customer pay all network charges for traffic. Lucent Technologies cannot be responsible for such charges and will not make any allowance or give any credit for charges that result from unauthorized access.

Trademarks

5ESS, DACScan, LGX, SLC, ST, and Western Electric are registered trademarks of Lucent Technologies, Inc.
ANSI is a registered trademark of American National Standards Institute, Inc.
Common Language is a registered trademark, and CLEI, CLLI, CLCI, and CLFI are trademarks of Bell Communications Research, Inc.
DEC is a trademark of Digital Equipment Corporation.
Gateway 2000 is a registered trademark of Gateway 2000, Inc.
Hayes is a registered trademark of Hayes Microcomputer Products, Inc.
HP is a registered trademark of Hewlett-Packard Company.
IBM is a registered trademark of International Business Machines Corporation.
IEEE is a registered trademark of The Institute of Electrical and Electronics Engineers, Inc.
MegaStar is a registered trademark of Harris Corporation.
Microsoft, MS-DOS, and Windows are registered trademarks of Microsoft Corporation.
National Electrical Code is a registered trademark of National Fire Protection Association, Inc.
NCR is a trademark of NCR Corporation.
NEC is a registered trademark of Nippon Denki Kabushiki Kaisha.
NMA and TIRKS are registered trademarks of Bell Communications Research, Inc.
Paradyne is a registered trademark of AT&T.
Penril is a registered trademark of Penril Corporation.
PROCOMM is a registered trademark of Datastorm Technologies, Inc.
RIDES is a registered trademark of Ericsson Raynet.
SAFARI is a registered trademark of AT&T.
SPARC is a registered trademark of SPARC International, Inc. licensed exclusively to SUN Microsystems, Inc.
Styrofoam is a registered trademark of The Dow Chemical Company.
SUN is a registered trademark of SUN Microsystems, Inc.
Titan is a registered trademark of Tellabs, Inc.
V-Series is a registered trademark of General Electric Capital Corporation.

Warranty

Lucent Technologies provides a 5-year limited warranty to this product. For more information, consult your local Account Executive.

Document Ordering Information

The ordering number for this document is 363-206-200. To order this document, call 1-888-582-3688. For more ordering information, refer to “How to Order Documents” in the section “About This Document.”

Customer Assistance and Technical Support

The Lucent Technologies Regional Technical Assistance Center (RTAC) provides a technical assistance telephone number which is staffed 24 hours a day. For technical assistance, simply call 1-800-225-RTAC in accordance with local operating procedures.

Documentation Support Telephone Number

Lucent Technologies provides a telephone number for you to report errors or to ask questions about the information in this document. The support telephone number is 1-888-584-6366.

Developed by Lucent Technologies Network Systems Customer Training and Information Products.

How Are We Doing?

Title: *DDM-2000 OC-12 User/Service Manual - Volume I*

Identification No.: *363-206-295* Issue No.: 1 Date: December 1997

Lucent Technologies welcomes your feedback on this Customer Information Product (CIP). Your comments can be of great value in helping us improve our CIPs.

1. Please rate the effectiveness of this CIP in the following areas:

	Excellent	Good	Fair	Poor	Not Applicable
Ease of Use					////////////////////
Clarity					////////////////////
Completeness					////////////////////
Accuracy					////////////////////
Organization					////////////////////
Appearance					////////////////////
Examples					
Illustrations					
Overall Satisifaction					////////////////////

2. Please check the ways you feel we could improve this CIP.

- ❒ Improve the overview/introduction
- ❒ Improve the table of contents
- ❒ Improve the organization
- ❒ Include more figures
- ❒ Add more examples
- ❒ Add more detail
- ❒ Make it more concise/brief
- ❒ Add more step-by-step procedures/tutorials
- ❒ Add more troubleshooting information
- ❒ Make it less technical
- ❒ Add more/better quick reference aids
- ❒ Improve the index

Please provide details for the suggested improvement. _____

3. What did you like most about this CIP?

4. Feel free to write any comments below or on an attached sheet.

If we may contact you concerning your comments, please complete the following:

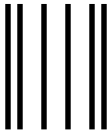
Name: _____ Telephone Number: _____

Company/Organization: _____ Date: _____

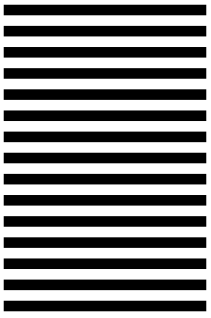
Address: _____

When you have completed this form, please fold, tape and return to address on back or Fax to: 910 727-3043.

--- Do Not Cut — Fold Here And Tape ---



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES



Lucent Technologies
Bell Labs Innovations



BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. 1999 GREENSBORO, NC

POSTAGE WILL BE PAID BY ADDRESSEE

DOCUMENTATION SERVICES
2400 Reynolda Road
Winston-Salem, NC 27199-2029



How Are We Doing?

Title: *DDM-2000 OC-12 User/Service Manual - Volume I*

Identification No.: *363-206-295* Issue No.: 1 Date: December 1997

Lucent Technologies welcomes your feedback on this Customer Information Product (CIP). Your comments can be of great value in helping us improve our CIPs.

1. Please rate the effectiveness of this CIP in the following areas:

	Excellent	Good	Fair	Poor	Not Applicable
Ease of Use					////////////////////
Clarity					////////////////////
Completeness					////////////////////
Accuracy					////////////////////
Organization					////////////////////
Appearance					////////////////////
Examples					
Illustrations					
Overall Satisifaction					////////////////////

2. Please check the ways you feel we could improve this CIP.

- ❒ Improve the overview/introduction
- ❒ Improve the table of contents
- ❒ Improve the organization
- ❒ Include more figures
- ❒ Add more examples
- ❒ Add more detail
- ❒ Make it more concise/brief
- ❒ Add more step-by-step procedures/tutorials
- ❒ Add more troubleshooting information
- ❒ Make it less technical
- ❒ Add more/better quick reference aids
- ❒ Improve the index

Please provide details for the suggested improvement. _____

3. What did you like most about this CIP?

4. Feel free to write any comments below or on an attached sheet.

If we may contact you concerning your comments, please complete the following:

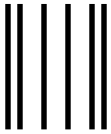
Name: _____ Telephone Number: _____

Company/Organization: _____ Date: _____

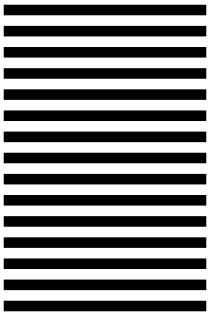
Address: _____

When you have completed this form, please fold, tape and return to address on back or Fax to: 910 727-3043.

--- Do Not Cut — Fold Here And Tape ---



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES



Lucent Technologies
Bell Labs Innovations



BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. 1999 GREENSBORO, NC

POSTAGE WILL BE PAID BY ADDRESSEE

DOCUMENTATION SERVICES
2400 Reynolda Road
Winston-Salem, NC 27199-2029



Contents

About This Document

- Purpose xli
- Intended Audiences xli
- Reason for Reissue xli
- Multi-Vendor OI xlii
- Safety Instructions xliii
  - Product Safety Labels xliii
  - Lightwave Safety Guidelines xliii
    - General Laser Information xliii
    - Lasers and Eye Damage xliv
    - Classification of Lasers xliv
    - Lightwave Safety Precautions xlv
    - Safety Precautions for Enclosed Systems xlvi
    - Safety Precautions for Unenclosed Systems xlvii
  - Electrostatic Discharge (ESD) Considerations xlvii
- Related Documentation lii
- Related Training lix
- Customer Technical Support (CTS) lxii
- Engineering and Installation Services lxvi
  - Customer Technical Support Enhanced Services lxvii
- Documentation Support lxvii
- How to Order Documents lxviii
  - Standing Orders lxix
- How to Comment on This Document lxx
- Electronic Documentation lxx

1 System Introduction

- Overview 1-1
- Introduction to the 2000 Product Family 1-1
- Introduction to the DDM-2000 OC-12 Multiplexer 1-2
- DDM-2000 OC-12 Multiplexer Releases 1-3
  - Release Descriptions 1-3

Contents

- DDM-2000 OC-12 Multiplexer Release 7.0 1-8
  - Release Description 1-8

2 Applications

- Overview 2-1
- Introduction 2-2
- Network Configurations 2-3
  - Path Switched Rings 2-3
    - OC-12 Path Switched Rings 2-6
    - OC-12 STS-1/VT1.5 Path Switched Ring (0x1) 2-12
  - Folded Ring 2-13
  - OC-3 Ring Transport on OC-12 Point-to-Point 2-14
  - Dual Homing 2-15
  - Dual Ring Interworking (DRI) 2-15
  - OC-3 Linear Optical Extensions from OC-3 and OC-12 Rings 2-22
    - OC-12 Point-to-Point (Folded Ring) 2-24
  - 2000 Product Family Interworking 2-26
    - *SLC*-2000 Access System 2-26
    - FT-2000 OC-48 Lightwave System 2-27
  - Multi-Vendor OI Applications 2-28
- Service Applications 2-29
  - Loop Feeder 2-29
  - Interoffice Transport 2-29
  - Broadband Business Access 2-30
  - STS-3c Video Broadcast Application 2-32
  - STS-3c Video Application ATM Interface 2-33
  - Locked STS-3c (0x1) Broadband Services 2-34
  - Teleprotection and Supervisory Control and Data Acquisition (SCADA) Applications 2-36
  - Intelligent Vehicle Highway System (IVHS) Applications 2-38

Contents

3 Shelf Descriptions and Configurations

- Overview 3-1
- DDM-2000 OC-12 Multiplexer Shelf 3-1
- DDM-2000 OC-12 Multiplexer Shelf Configurations 3-7
  - OC-12 STS-1 Path Switched Ring Shelf 3-9
  - OC-12 STS-1/VT1.5 Path Switched Ring Configuration 3-10
  - OC-3/IS-3 Dual Ring Interworking (DRI) Configuration 3-11
  - OC-12 Ring Configuration (DS1/EC-1 Low-Speed Interfaces) 3-12
  - OC-12 Optical Extension Shelf 3-13
  - Linear (1+1) Extension From OC-12 Ring Configuration 3-14
  - OC-12 Dual Homing Shelf 3-15
  - OC-12 STS-3c Broadcast Shelf 3-16
  - OC-12 OC-3c Transport Shelf 3-17
- DDM-2000 Fan Shelf 3-18

4 Power

- Overview 4-1
- Introduction 4-1
- Power Description 4-2
  - Circuit Packs 4-3
    - OLIU Circuit Packs 4-3
    - TSI, TGS/TG3, 3DS3, and 3STS1E Circuit Packs 4-3
    - Control Circuit Packs 4-3
  - LEDs 4-4
  - Power Minor Alarm 4-4
  - Power Distribution 4-5

Contents

5 Transmission and Synchronization Interfaces

- Overview 5-1
- Transmission Interfaces 5-1
  - OC-12 STS-1 Path Switched Ring 5-2
  - Dual Ring Interworking (DRI) 5-4
  - OC-3/OC-12 Ring (0x1) Low-Speed Interfaces 5-4
  - Linear (1+1) Optical Extension Between OC-12 and OC-3 5-8
- Synchronization Interfaces 5-10
  - Free-Running 5-10
  - Line Timing 5-10
  - DS1 External 5-10
    - Holdover 5-11
  - DS1 Output Modes: MULT and SYNC OUT 5-11
    - DS1 Output Mode, MULT 5-11
    - DS1 Output Mode, SYNC OUT 5-12
  - Synchronization Messaging 5-16
    - Applications 5-16
    - DS1 Timing Output Integrity 5-17
    - Automatic Synchronization Reconfiguration 5-19
    - Synchronization Provisioning Integrity 5-21
    - Feature Details and Options 5-21
    - Examples 5-24
      - Synchronization Reconfiguration Using an Externally Timed Access Ring 5-24
      - Synchronization Reconfiguration in an Access Ring 5-27
  - Network Timing Distribution 5-30
    - Interoffice Timing Distribution 5-30
    - Access Network Timing Distribution 5-32

Contents

6 Operations Interfaces

- Overview 6-1
- Craft Interface Terminals (CIT) 6-2
  - Local Access 6-4
  - Using a PC as a CIT 6-6
  - Modem Access 6-6
  - Remote Access Using the Data Communications Channel (DCC) 6-7
  - CPro-2000 Graphical User Interface and Provisioning Tool 6-8
- User Panel 6-8
  - User Panel LEDs 6-10
  - FE SEL Pushbutton 6-10
  - ACO/TST Pushbutton 6-10
  - UPD/INIT Pushbutton 6-11
  - Pushbutton Combinations 6-11
- Equipment Indicators 6-12
  - FAULT Indicators 6-12
  - ACTIVE Indicators 6-12
- Office Alarms 6-13
- TL1/X.25 Interface 6-14
  - ITM SNC 6-15
- IAO LAN Interface 6-15
- User-Definable Miscellaneous Discretes—Environmental Alarms and Controls 6-16

7 Circuit Pack Descriptions

- Overview 7-1
- Introduction 7-1
- Compatibility 7-2

Contents

- Universal Optical Connector 7-2
- Control 7-4
  - Control Circuit Packs 7-4
  - BBG8/BBG8B SYSCTL Circuit Pack Description 7-5
    - Purpose of Circuit 7-5
    - BBG8/BBG8B SYSCTL Faceplate Controls and Indicators 7-5
    - General Description of Operation 7-6
    - Detailed Description of Operation 7-6
      - Control Circuitry 7-6
      - Memory 7-6
      - Transmission/Timing Circuit Pack Interfaces 7-8
      - Operation Interfaces 7-8
      - OC-12 Transport Overhead Channel 7-8
      - Power Monitoring and Fan Control 7-9
      - Interface to Other DDM-2000 OC-12 Shelves 7-9
      - Power Circuitry 7-9
    - BBG8/BBG8B SYSCTL Hardware Setting 7-10
    - BBG8/BBG8B SYSCTL Quick Reference Summary 7-11
      - Interface Functions 7-11
      - User Panel 7-11
      - Telemetry Functions 7-11
      - Maintenance Functions 7-11
  - BCP4 OHCTL Circuit Pack Description 7-12
    - Purpose of Circuit 7-12
    - Faceplate Indicator 7-12
    - General Description of Operation 7-13
    - Detailed Description of Operation 7-13
      - OC-12 Transport Overhead Channel 7-13
      - User Definable Miscellaneous Discrete Environmental Alarms and Controls 7-13
      - X.25 Message-Based Operation Interface 7-13

Contents

Interface Circuitry 7-15
Maintenance Features and Modes 7-15
Power Circuitry 7-15
OHCTL Quick Reference Summary 7-15
Functions 7-15
■ Synchronization 7-16
Synchronization Functions 7-16
BBF2B/BBF4 TGS/TG3 Circuit Pack Description 7-16
Purpose of Circuit 7-16
TG Faceplate Indicators 7-17
General Description of Operation 7-18
DS1 Timing Output 7-18
Detailed Description of Operation 7-19
Control Circuitry 7-19
Timing Circuitry 7-20
Clock Output Functions 7-21
Protection Circuitry 7-21
Fault Detection Circuitry 7-22
Power Circuitry 7-22
TG Hardware Settings 7-22
TG Quick Reference Summary 7-24
Provisioned Modes 7-24
Holdover Mode 7-24
Maintenance and Control 7-24
DS1 Output 7-24
■ Transmission 7-25
BBG11 3DS3 Circuit Pack Description 7-25
Purpose of Circuit 7-25
BBG11 3DS3 Faceplate Indicators 7-25
General Description of Operation 7-26
Detailed Description of Operation 7-26
Transmission Circuitry 7-26
Control Circuitry 7-28

Contents

Timing Circuitry 7-28
Protection Circuitry 7-28
Fault Detection Circuitry 7-29
Power Circuitry 7-29
BBG11 3DS3 Hardware Settings 7-30
BBG11 3DS3 Quick Reference Summary 7-31
Transmit Functions 7-31
Receive Functions 7-31
Control Functions 7-31
Maintenance Signal Functions 7-31
BBG11B 3DS3 Circuit Pack Description 7-32
Purpose of Circuit 7-32
BBG11B 3DS3 Faceplate Indicators 7-32
General Description of Operation 7-33
Detailed Description of Operation 7-33
Transmission Circuitry 7-33
Control Circuitry 7-35
Timing Circuitry 7-35
Protection Circuitry 7-35
Fault Detection Circuitry 7-36
Loopbacks 7-36
Performance Monitoring 7-36
Power Circuitry 7-37
BBG11B 3DS3 Hardware Settings 7-37
BBG11B 3DS3 Quick Reference Summary 7-38
Transmit Functions 7-38
Receive Functions 7-38
Control Functions 7-38
Maintenance Signal Functions 7-39
BBG12 3STS1E Circuit Pack Description 7-40
Purpose of Circuit 7-40
BBG12 3STS1E Faceplate Indicators 7-40
General Description of Operation 7-41

Contents

Detailed Description of Operation 7-41
Transmission Circuitry 7-41
Control Circuitry 7-41
Timing Circuitry 7-42
Protection Circuitry 7-42
Fault Detection Circuitry 7-43
Power Circuitry 7-43
BBG12 3STS1E Hardware Settings 7-44
BBG12 3STS1E Quick Reference Summary 7-45
Transmit Functions 7-45
Receive Functions 7-45
Control Functions 7-45
Maintenance Signal Functions 7-45
BCP3 TSI FLEX Circuit Pack Description 7-46
Purpose of Circuit 7-46
BCP3 Faceplate Indicators 7-46
General Description of Operation 7-47
Detailed Description of Operation 7-47
Transmission Circuitry 7-47
Clock and Frame SYNC Distribution 7-47
Maintenance Features and Modes 7-49
Power Circuitry 7-49
BCP3 Quick Reference Summary 7-50
Interface Functions 7-50
Control Functions 7-50
Maintenance Functions 7-50
21D/21D-U OLIU Circuit Pack Description 7-51
Purpose of Circuit 7-51
21D and 21D-U OLIU Faceplate Indicators 7-51
General Description of Operation 7-52
Detailed Description of Operation 7-52
Transmission Circuitry 7-53
Control Circuitry 7-53
Timing Circuitry 7-53

Contents

Protection Circuitry 7-54
Fault Detection Circuitry 7-54
Performance Monitoring 7-54
Power Circuitry 7-54
21D/21D-U OLIU Quick Reference Summary 7-55
Transmit Functions 7-55
Receive Functions 7-55
Control Functions 7-55
Maintenance Signal Functions 7-55
21G/21G-U/21G2-U OLIU Circuit Pack Description 7-56
Purpose of Circuit 7-56
21G/21G-U/21G2-U OLIU Faceplate Indicators 7-56
General Description of Operation 7-57
Detailed Description of Operation 7-57
Transmission Circuitry 7-59
Control Circuitry 7-59
Timing Circuitry 7-59
Protection Circuitry 7-60
Fault Detection Circuitry 7-60
Performance Monitoring 7-60
Power Circuitry 7-60
21G/21G-U OLIU Hardware Settings 7-61
21G/21G-U/21G2-U OLIU Quick Reference Summary 7-62
Transmit Functions 7-62
Receive Functions 7-62
Control Functions 7-62
Maintenance Signal Functions 7-63
23G/23G-U OLIU Circuit Pack Description 7-64
Purpose of Circuit 7-64
23G/23G-U OLIU Faceplate Indicators 7-64
General Description of Operation 7-65
Detailed Description of Operation 7-66

Contents

Transmission Circuitry 7-66
Control Circuitry 7-67
Timing Circuitry 7-68
Protection Circuitry 7-68
Fault Detection Circuitry 7-68
Performance Monitoring 7-68
Power Circuitry 7-68
23G/23G-U OLIU Quick Reference Summary 7-69
Transmit Functions 7-69
Receive Functions 7-69
Control Functions 7-69
Maintenance Signal Functions 7-69
23H/23H-U OLIU Circuit Pack Description 7-70
Purpose of Circuit 7-70
23H/23H-U OLIU Faceplate Indicators 7-70
General Description of Operation 7-71
Detailed Description of Operation 7-72
Transmission Circuitry 7-72
Control Circuitry 7-73
Timing Circuitry 7-74
Protection Circuitry 7-74
Fault Detection Circuitry 7-74
Performance Monitoring 7-74
Power Circuitry 7-74
23H/23H-U OLIU Quick Reference Summary 7-75
Transmit Functions 7-75
Receive Functions 7-75
Control Functions 7-75
Maintenance Signal Functions 7-75
177B Apparatus Blank Description 7-76
Purpose of Apparatus Blank 7-76
177C Apparatus Blank Description 7-77
Purpose of Apparatus Blank 7-77

Contents

8 Administration and Provisioning

- Overview 8-1
- Administration 8-1
  - Version Recognition 8-1
  - Security 8-2
  - Software Upgrades 8-4
    - Remote Software Download and Copy 8-4
  - Software Compatibility 8-4
    - Controller Maintenance 8-5
    - Memory Administration 8-5
  - System Backup and Restoral 8-6
      - ITM SNC 8-6
    - Service-Affecting Actions 8-6
- Multiplexing and Mapping 8-7
  - DS3 to OC-12 8-7
  - OC-3 to OC-12 8-7
  - OC-3c to OC-12 (Optional Feature) 8-8
  - EC-1 to OC-12 8-8
- Provisioning 8-9
  - Default Provisioning 8-9
  - Remote Provisioning 8-9
  - Automatic Provisioning 8-9
    - Circuit Pack Replacement 8-9
  - Feature Package Provisioning 8-10
  - Data Communications Channel (DCC) Provisioning 8-10
  - Operations Interworking (OI) Provisioning 8-11
    - NSAP Provisioning 8-11
    - TARP Provisioning 8-12
    - Level 2 Provisioning 8-12
  - Port State Provisioning 8-13
  - Channel State Provisioning 8-13

Contents

Line State Provisioning 8-14
Remote OS Access (TL1/X.25 GNE) 8-14
Remote CIT Login 8-14
Remote Software Download and Copy 8-14
Subnetwork Size 8-14
■ Cross-Connection Provisioning 8-15
Cross-Connection Types 8-15
Ring (0x1) Cross-Connections 8-15
Video Cross-Connections 8-15
Drop and Continue Cross-Connections 8-15
Pass-Through Cross-Connections 8-16
Manual OC-12 Ring Cross-Connections 8-16
Video/Broadband Applications 8-20
OC-12 Path Protected Ring Application 8-20
OC-12 Path Protected Ring Drop and Continue Application 8-20
OC-12 Ring Network Cross-Connection Example 8-21
Ring Drop and Continue Cross-Connection Provisioning 8-25
OC-12 Ring Network Drop and Continue Cross-Connection Example 8-28
Single Homed OC-3/OC-12 VT1.5 Path Switched Ring (0x1) 8-30
Example Cross-Connections 8-31
Dual Homed OC-3/OC-12 VT1.5 Path Switched Ring (0x1) 8-34
Example Cross-Connections 8-34
Example Cross-Connections 8-36
Switch Selectable Parameters 8-38
Craft Interface Terminal (CIT) Selectable Parameters 8-39
Identifiers (IDs) 8-43
Performance Monitoring (PM) Parameters Provisionable via the CIT 8-43

Contents

9 Maintenance Description

- Overview 9-1
  - Three-Tiered Operations 9-1
- Single-Ended Maintenance Philosophy 9-4
  - Multi-Vendor OI 9-6
- In-service (IS) Upgrades 9-8
  - Software Upgrades 9-8
- DDM-2000 OC-3 and OC-12 Software Compatibility 9-9
- Maintenance Signaling 9-10
- Fault Detection, Isolation, and Reporting 9-16
  - Detection 9-16
  - Isolation 9-16
  - Reporting 9-16
- Protection Switching 9-17
  - Automatic Line Protection 9-17
    - Status of ACTIVE LED on OLIUs 9-17
    - APS Initiation Criteria 9-18
  - Equipment Protection 9-20
  - Synchronization Reference Protection 9-20
  - Path Protection Switching (Path Switched Rings) 9-21
    - Path Protection Scheme 9-22
    - Dual Ring Interworking (DRI) Path Protection Scheme 9-24
  - OC-3/OC-12 Path Switched Ring (0x1) 9-26
    - Status of ACTIVE LED on Rings 9-26
- Loopbacks 9-26
- Tests 9-27
  - Transmission Tests 9-27
  - Operations Interface Tests 9-27
- Performance Monitoring (PM) 9-27
  - DS3 Performance Monitoring (PM) 9-29
    - DS3 Path PM 9-29
      - P-Bit 9-29

Contents

Adjusted F&M Bit 9-29
C-Bit 9-30
DS3 Line Performance Monitoring 9-30
DS3 Performance Monitoring Parameters 9-30
Optical Parameters 9-33
Performance Monitoring (PM) Enabling 9-33
Laser Bias Current 9-33
Optical Transmit Power 9-33
OC-3 and OC-12 Section Parameters 9-33
Performance Monitoring (PM) Enabling 9-33
Severely Errored Frame Seconds (SEFS) 9-33
OC-3 and OC-12 Line Parameters 9-34
Performance Monitoring (PM) Enabling 9-34
Line Coding Violations (B2 Parity) 9-34
Errored Seconds (ES) 9-34
Severely Errored Seconds (SES) 9-34
Unavailable Seconds (UAS) 9-34
Line Protection Switch Counts 9-35
EC-1 Line Parameters 9-35
Performance Monitoring Enabling 9-35
Line Coding Violations (B2 Parity) 9-35
Errored Seconds (ES) 9-35
Severely Errored Seconds (SES) 9-36
Unavailable Seconds (UAS) 9-36
Line Protection Switch Counts 9-36
STS-1 Path Parameters 9-36
Performance Monitoring Enabling 9-36
STS-1 Path Coding Violations (B3 Parity) 9-36
Errored Seconds (ES) 9-37
Severely Errored Seconds (SES) 9-37
Unavailable Seconds (UAS) 9-37
DS3 Path Parameters 9-37
Performance Monitoring (PM) Enabling 9-37

CV-P Coding Violations 9-38
Severely Errored Frame Seconds (SEFS) 9-38
Errored Seconds (ES-P) 9-38
Severely Errored Seconds (SES-P) 9-38
Unavailable Seconds (UAS-P) 9-39
DS3 Line Parameters 9-40
Coding Violations (CV-L) 9-40
Errored Seconds (ES-L) 9-40
Severely Errored Seconds (SES-L) 9-40
Performance Monitoring Data Storage and Reports 9-40
Performance Monitoring During Failed Conditions 9-40
Performance Parameter Thresholds 9-40
TCA Transmission to OS 9-41
Performance Monitoring Reports 9-41
TCA Summary Report 9-41
Performance Status Reports 9-41
■ Reports 9-42
Database Change Transmission to OS 9-42
Alarms and Status Report 9-42
Provisioning Reports 9-42
Maintenance History Report 9-42
State Reports 9-43
Equipment Report 9-43
Neighbor Map Report 9-43
Network Map Report 9-43

10 Technical Specifications

■ Overview 10-1
■ DDM-2000 OC-12 Multiplexer 10-1
External Transmission Interfaces 10-1

Contents

Electrical Interfaces 10-2
DS3 Low-Speed (BBG11/11B 3DS3) 10-2
EC-1 Low-Speed (BBG12 3STS1E) 10-5
Optical Interfaces 10-6
Lightguide Jumpers 10-6
Long Reach OC-3 Interface (21G/21G-U/ 21G2-U OLIU) 10-7
IS-3 Interface (21D/21D-U OLIU) 10-8
Long Reach 1310 nm OC-12 Interface (23G/ 23G-U OLIU) 10-13
Long Reach 1550 nm OC-12 Interface (23H/ 23H-U OLIU) 10-13
OC-3 Optical Interface Mixing 10-17
Universal Optical Connector Attenuators 10-21
SONET Overhead Bytes 10-22
Performance 10-22
Wander/Jitter 10-22
Signal Performance 10-22
Synchronization 10-22
Synchronous Timing Generator (BBF2/ BBF2B) 10-22
Synchronous Timing Generator 3 (BBF4) 10-23
Protection Switching 10-23
Ring Networks 10-23
Transient Performance 10-24
Power Loss Restart 10-24
Transmission Start-Up on Signal Application 10-24
Delay 10-24
Performance Monitoring 10-24
Operations Interfaces (OI) 10-26
Craft Interface Terminal (CIT) 10-26
Personal Computer Specifications for Software Download 10-27
Compatible Modems 10-28
CPro-2000 Graphical User Interface and Provisioning Tool 10-29

Contents

User Panel 10-29
Equipment Indicators 10-30
Office Alarms 10-30
User-Definable Miscellaneous Discretes—Environmental Alarms and Controls 10-30
TL1/X.25 Interface 10-31
Physical Specifications 10-33
OC-12 Shelf Physical Characteristics 10-33
Fan Shelf Physical Characteristics 10-33
Network Bay and Cabinet Mounting 10-33
Environmental Specifications 10-34
Temperature and Humidity 10-34
1550 nm Systems 10-34
EMC Requirements 10-34
Earthquake Requirements 10-34
Fire Resistance 10-35
Underwriters Laboratories 10-35
Canadian Standards Association 10-35
Power Requirements 10-35
Shelf Fuses 10-35
Power Dissipation 10-36
DDM-2000 OC-12 Reliability 10-38
Summary 10-38
Transmission Availability 10-38
Operation System Interface Availability 10-39
Optical Module Maintenance Objective 10-39
Infant Mortality 10-39
DDM-2000 OC-12 System Reliability Predictions 10-40

Contents

11 Commands and Reports

Overview 11-1
Command Page Format 11-1
Addresses 11-3
Special Control Characters 11-7
DDM-2000 OC-12 Command Menu 11-10
CPro-2000 11-16
Commands 11-17
RTRV-ALM Reports 11-356
RTRV-HSTY Reports 11-373

A A SONET Overview

- Overview A-1
- History A-1
- Basic Purpose A-2
- Technical Overview A-2

SONET Signal Hierarchy A-2
SONET Layers A-4
SONET Frame Structure A-6
Section Overhead A-6
Line Overhead A-7
Path Overhead A-8
STS-1 Path Overhead A-8
VT Path Overhead A-9
SONET Multiplexing Procedure A-10
SONET Demultiplexing Procedure A-12
SONET Digital Multiplexing Schemes A-14
Asynchronous Multiplexing A-14
Synchronous Multiplexing A-15

Contents

Virtual Tributary Signals A-15
Concatenated Mode A-16
- SONET Interface A-17
SONET Payloads A-18
Higher Rate Transport A-19
- Conclusion A-19

GL Glossary GL-1

IN Index IN-1

Software Release Description

Volume II — Operation and Maintenance TOP

Figures

2 Applications

2-1	Path Switched Ring	2-5
2-2	OC-12 Path Switched Ring — STS-1 Level Path Switching	2-6
2-3	OC-12 Path Switched Ring Using OC-12 Multiplexer—Mixed STS-1 and VT1.5 Path Switching	2-7
2-4	OC-3 Ring with OC-12 Ring Transport	2-8
2-5	Multinode OC-3 Ring With OC-12 Ring Transport	2-10
2-6	DDM-2000 OC-12 Path Switched Interoffice Ring	2-11
2-7	Folded Ring Configuration	2-13
2-8	OC-3 Ring Transport on OC-12 Point-to-Point	2-14
2-9	Dual Access Configuration	2-16
2-10	Dual Ring Interworking Concepts	2-17
2-11	OC-3/12 to FT-2000 OC-48 Lightwave System Dual Ring Interworking	2-19
2-12	DDM-2000 Ring Interworking with FT-2000 OC-48 Lightwave System Transport and DACS IV-2000 Grooming	2-21
2-13	OC-3 Services Using Linear Optical Extensions	2-23
2-14	OC-12 Point-to-Point Loop Configuration (Folded Ring)	2-24
2-15	OC-12 Point-to-Point Interoffice Configuration (Folded Ring)	2-25
2-16	OC-3 Loop Carrier Interface Configuration	2-26
2-17	OC-12 Ring Interfaces with FT-2000 OC-48 Lightwave System	2-27
2-18	Interworking of OC-1/OC-3/OC-12/OC-48 with Tellabs TITAN 5500 DCS	2-28
2-19	Self-Healing Medical Campus Network Application	2-31
2-20	STS-3c Video Broadcast Application	2-32
2-21	STS-3c Video Broadcast Application for ATM Interface	2-33

Figures

2-22	Locked (0x1) STS-3c - Broadband Services	2-35
2-23	Teleprotection and SCADA Application	2-37
2-24	Intelligent Vehicle Highway System (IVHS) Application	2-39

3 Shelf Descriptions and Configurations

3-1	DDM-2000 OC-12 Shelf — Front View	3-3
3-2	DDM-2000 OC-12 Shelf — Rear View	3-3
3-3	DDM-2000 OC-12 Front Panel	3-6
3-4	OC-12 STS-1 Path Switched Ring Shelf	3-9
3-5	OC-12 STS-1/VT1.5 Path Switched Ring Configuration	3-10
3-6	OC-3/IS-3 Dual Ring Interworking Configuration	3-11
3-7	OC-12 Ring Configuration (DS1/EC-1 Low-Speed Interfaces)	3-12
3-8	OC-12 Optical Extension Shelf	3-13
3-9	Linear (1+1) Extension From OC-12 Ring Configuration	3-14
3-10	DDM-2000 OC-12 Dual Homing Shelf	3-15
3-11	DDM-2000 OC-12 STS-3c Broadcast Shelf	3-16
3-12	DDM-2000 OC-12 OC-3c Transport Shelf	3-17
3-13	DDM-2000 Fan Shelf	3-18
3-14	DDM-2000 Fan Shelf — Fan Switches — Front Cover Removed	3-19

4 Power

4-1	DDM-2000 OC-12 Multiplexer Power Architecture	4-2
4-2	Circuit Pack Power and LED Control	4-4
4-3	Typical -48 Volt Power Supply for DDM-2000 OC-12 Single Shelf	4-5

Figures

5 Transmission and Synchronization Interfaces

5-1	OC-12 Multiplexer Block Diagram — STS-1/ VT1.5 Path Switched Ring Node	5-3
5-2	OC-3/OC-12 Ring (0x1) Low-Speed Interfaces Single Homing	5-5
5-3	OC-3/OC-12 Ring Low-Speed Interfaces (0x1) Dual Homing	5-7
5-4	OC-12 Ring Shelf with Linear (1+1) OC-3 Low-Speed Interfaces (Transmit)	5-8
5-5	OC-12 Ring Shelf with Linear (1+1) OC-3 Low-Speed Interfaces (Receive)	5-9
5-6	Synchronization Timing Configurations	5-13
5-7	DS1 Timing Output — Dual Homing Linear	5-18
5-8	Synchronization Reconfiguration — Access Ring	5-20
5-9	Synchronization Reconfiguration — Externally Timed Access Ring	5-25
5-10	Synchronization Reconfiguration — Access Ring	5-27
5-11	OC-N Derived DS1 Timing Reference	5-31
5-12	Timing from Multiplexed DS1	5-33

6 Operations Interfaces

6-1	Craft Interface Terminal Connectors	6-4
6-2	Craft Interface Terminal Login Sessions	6-5
6-3	User Panel for Group 4 Shelf	6-9
6-4	Miscellaneous Discretes	6-17

7 Circuit Pack Descriptions

7-1	Universal Optical Connector	7-3
7-2	BBG8/BBG8B SYSCTL Circuit Pack	7-5

Figures

7-3	BBG8/BBG8B SYSCTL Circuit Pack Block Diagram	7-7
7-4	BBG8/BBG8B SYSCTL Option Switches	7-10
7-5	BCP4 OHCTL Circuit Pack	7-12
7-6	BCP4 OHCTL Circuit Pack Block Diagram	7-14
7-7	BBF2B TGS and BBF4 TG3 Circuit Pack	7-17
7-8	BBF2B TGS and BBF4 TG3 Circuit Pack Block Diagram	7-19
7-9	TG Option Switches for DDM-2000 OC-3	7-23
7-10	BBG11 3DS3 Circuit Pack	7-25
7-11	BBG11 3DS3 Circuit Pack Block Diagram	7-27
7-12	3DS3 Line Build-Out (LBO) Jumpers	7-30
7-13	BBG11B 3DS3 Circuit Pack	7-32
7-14	BBG11B 3DS3 Circuit Pack Block Diagram	7-34
7-15	3DS3 Line Build-Out Jumpers	7-37
7-16	BBG12 3STS1E Circuit Pack	7-40
7-17	BBG12 3STS1E Circuit Pack Block Diagram	7-42
7-18	3STS1E Line Build-Out Jumpers	7-44
7-19	BCP3 Circuit Pack	7-46
7-20	BCP3 Circuit Pack Block Diagram	7-48
7-21	21D and 21D-U OLIU Circuit Packs	7-51
7-22	21D/21D-U OLIU Circuit Pack Block Diagram	7-52
7-23	21G and 21G-U/21G2-U OLIU Circuit Packs	7-56
7-24	21G/21G-U/21G2-U OLIU Circuit Pack Block Diagram	7-58
7-25	21G/21G-U OLIU Output Level Switch	7-61
7-26	23G and 23G-U OLIU Circuit Packs	7-64
7-27	23G/23G-U OLIU Circuit Pack Block Diagram	7-66
7-28	23H and 23H-U OLIU Circuit Packs	7-70
7-29	23H/23H-U OLIU Circuit Pack Block Diagram	7-72
7-30	177B Apparatus Blank	7-76
7-31	177C Apparatus Blank	7-77

Figures

8 Administration and Provisioning

8-1 OC-12 Ring Configuration Cross-Connections DS3 to DS3 With STS-1 Cross-Connections 8-23

8-2 Drop and Continue Nodes 8-27

8-3 Example Dual Ring Configuration Cross-Connections 8-29

8-4 Example Single Homed OC-3/OC-12 Ring (0x1) Configuration Cross-Connections 8-33

8-5 Example Dual Homed OC-3/OC-12 Ring (0x1) Cross-Connections 8-35

8-6 Example Dual Homed OC-3/OC-12 Ring (0x1) Cross-Connections with Intermediate Node 8-37

9 Maintenance Description

9-1 Three-Tiered Operations 9-3

9-2 Single-Ended Operations 9-5

9-3 Example of Main Signal as a Result of Unprotected Incoming OC-12 Failure 9-11

9-4 Maintenance Signaling — Path Switched Ring Applications 9-12

9-5 Unidirectional Line Protection Switching 9-19

9-6 Two-Fiber Unidirectional Ring 9-21

9-7 Path Protection Switching 9-23

9-8 DRI Path Protection Switching 9-25

9-9 DS1/DS3 Line and Path and DS3 Path Performance Monitoring 9-28

10 Technical Specifications

10-1 Optical System Interfaces (Points S and R) 10-7

Figures

11 Commands and Reports

11-1	EC1 Loopbacks	11-92
11-2	DS3 Loopbacks	11-94
11-3	Automated Transmission Test of DS3 Signal in MUX Direction	11-344
11-4	Automated Transmission Test of DS3 Signal in DEMUX Direction	11-345

A A SONET Overview

A-1	SONET STS-1 Frame — Simplified Version	A-3
A-2	Section, Line, and Path Definitions	A-4
A-3	SONET Frame Format	A-5
A-4	VT Path Overhead Byte	A-9
A-5	SONET Multiplexing Procedure	A-11
A-6	SONET Demultiplexing Procedure	A-12
A-7	STS-1 Synchronous Payload Envelope in Interior of STS-1 Frame	A-13
A-8	Asynchronous Multiplexing	A-14
A-9	Synchronous Multiplexing	A-15
A-10	STS-3c Concatenated Payload	A-16
A-11	SONET Interface	A-17

Tables

3 Shelf Descriptions and Configurations

3-1	DDM-2000 OC-12 Plug-Ins	3-4
3-2	DDM-2000 OC-12 Multiplexer Circuit Pack and Software Compatibility Matrix	3-8
3-3	DDM-2000 Fan Shelf Switch Settings	3-20

5 Transmission and Synchronization Interfaces

5-1	DDM-2000 OC-12 Multiplexer Application Summary Matrix	5-2
5-2	DDM-2000 OC-12 Multiplexer Synchronization	5-14
5-3	Synchronization Messages using K2 Byte	5-21
5-4	Synchronization Messages using S1 Byte	5-22
5-5	Available Synchronization References	5-23

6 Operations Interfaces

6-1	Craft Interface Terminals	6-3
6-2	DDM-2000 OC-12 Pushbutton Combinations	6-11

8 Administration and Provisioning

8-1	OI Software Compatibility	8-11
8-2	DDM-2000 OC-12 Manual STS-1 Cross-Connections (Termination).	8-17
8-3	DDM-2000 OC-12 Manual STS-3c Cross-Connections (Termination).	8-17
8-4	DDM-2000 OC-12 Manual STS-1 Cross-Connections (Rings Pass-Through)	8-18

Tables

8-5 DDM-2000 OC-12 Manual STS-3c Cross-Connections (Rings Pass-Through) 8-18
8-6 DDM-2000 OC-12 Manual STS-1 Cross-Connections (Rings Drop and Continue) 8-19
8-7 DDM-2000 OC-12 Manual STS-3c Cross-Connections (Rings Drop and Continue) 8-19
8-8 DDM-2000 OC-12 Manual STS-3c Cross-Connections (RTV) 8-19
8-9 DDM-2000 OC-12 Manual STS-3c Cross-Connections (COV) 8-20
8-10 Parameters Provisionable via Hardware Switches 8-38
8-11 Parameters Provisionable via the CIT 8-39

9 Maintenance Description

9-1 DDM-2000 OC-12 In-service Software Upgrade Compatibility 9-8
9-2 DDM-2000 OC-3 and OC-12 Software Compatibility 9-9
9-3 DDM-2000 OC-3 Multiplexer DRI Software Compatibility 9-9
9-4 DDM-2000 OC-12 Multiplexer Performance Monitoring Parameters 9-31
9-5 DS3 Performance Monitoring Modes 9-38
9-6 DS3 Performance Monitoring (PM) Modes 9-39

10 Technical Specifications

10-1 Transmission Interface Standards 10-1
10-2 DS3 Performance Monitoring (PM) Mode 10-3
10-3 Enhanced DS3 Performance Monitoring Modes 10-3
10-4 21G/21G-U/21G2-U and 21D/21D-U OLIU Specifications 10-9

Tables

10-5	21G/21G-U and 21D/21D-U OLIU Link Budgets	10-10
10-6	OC-3 OLIUs Link Budget—Multimode Operation	10-12
10-7	23G/23G-U and 23H/23H-U OLIU Specifications	10-14
10-8	23G/23G-U and 23H/23H-U OLIU Link Budgets	10-15
10-9	OC-3 Rate OLIU Mixes - Minimum Link Budgets	10-17
10-10	OC-3 Rate OLIU Mixes — Maximum Link Budgets for SM Fiber (dB)	10-19
10-11	OC-3 Rate OLIU Mixes—Maximum Link Budgets for MM Fiber (dB)	10-20
10-12	Universal Buildout Attenuators	10-21
10-13	OC-12 Multiplexer and OC-12 Regenerator Transmission Delay in Microseconds	10-24
10-14	Performance Monitoring Parameters Provisionable via the CIT	10-25
10-15	CIT Interface Pin Connection	10-26
10-16	TL1/X.25 Interface — VC Assignments	10-31
10-19	TL1/X.25 Interface — EIA-232-D Pin Connections	10-32
10-17	TL1/X.25 Interface — X.25 Packet Layer Parameters	10-32
10-18	TL1/X.25 Interface — LAPB Link Layer Parameters	10-32
10-20	Power Dissipation and Current Drains	10-36
10-21	DDM-2000 OC-12 System Reliability Prediction	10-40
10-22	DDM-2000 OC-12 Circuit Pack Reliability	10-41
10-23	DDM-2000 Fan Shelf Steady State Failure Rates (Based on Bellcore RPP Issue 4 Data)	10-41

11 Commands and Reports

11-1	DDM-2000 OC-12 Address Table	11-4
11-2	DDM-2000 OC-12 Command Menu	11-10
11-3	RTRV-ALM Descriptions	11-359
11-4	RTRV-HSTY Descriptions	11-375

Tables

A A SONET Overview

A-1 SONET Payloads A-18

A-2 SONET Transport Rates A-19

About This Document

Table of Contents

Purpose xli

Intended Audiences xli

Reason for Reissue xli

Multi-Vendor OI xlii

Safety Instructions xliii

- Product Safety Labels xliii
- Lightwave Safety Guidelines xliii
  - General Laser Information xliii
  - Lasers and Eye Damage xliv
  - Classification of Lasers xliv
  - Lightwave Safety Precautions xlv
  - Safety Precautions for Enclosed Systems xlvi
  - Safety Precautions for Unenclosed Systems xlvii
- Electrostatic Discharge (ESD) Considerations xlvii

Related Documentation lii

Related Training lix

Customer Technical Support (CTS) lxii

Engineering and Installation Services lxvi

- Customer Technical Support Enhanced Services lxvii

Documentation Support lxvii

How to Order Documents lxviii

- Standing Orders lxix

How to Comment on This Document lxx

Electronic Documentation lxx

Table of Contents

About This Document

Purpose

This *DDM-2000 OC-12 Multiplexer User/Service Manual, Volume I,* covers Release 7.0 and provides the following:

- Detailed descriptive information to circuit pack level
- Technical specifications
- Commands and reports descriptions.

The *DDM-2000 OC-12 Multiplexer User/Service Manual (TOP), Volume II,* covers Release 7.0 and provides operation and maintenance (O&M) task oriented practice (TOP) supporting acceptance, turnup, and maintenance.

Intended Audiences

This user/service manual is used by training and by the end users responsible for O&M of the DDM-2000 OC-12 Multiplexer. It may be used by anyone desiring specific information about the DDM-2000 OC-12 Multiplexer O&M.

Reason for Reissue

This is Issue 1 of this document. It is based upon the *DDM-2000 OC-12 Multiplexer User/Service Manual, Volume I*, Issue 2 (363-206-290). It has been updated with information exclusively on Release 7.0. Significant changes to this document are noted by change bars (|) in the outermost margins.

Multi-Vendor OI

To support multi-vendor OI, DDM-2000 OC-12 R7.0 supports Target ID Address Resolution Protocol (TARP) instead of Lucent Directory Service (LDS). DDM-2000 OC-3 R13.0, FiberReach R3.0, and FT-2000 OC-48 R8.0 also support TARP, thus Lucent 2000 Product Family OI compatibility is still supported but not OI compatibility with previous releases of DDM-2000 and FT-2000. TARP is the established multi-vendor standard for SONET NEs that support TL1 OS interfaces.

DDM-2000 OC-12 R7.0 is developed to be compatible with any other-vendor NEs that also support TARP, OSI, IAO LAN, and TL1/X.25 as specified in Bellcore GR-253. In addition, DDM-2000's TARP Manual Adjacency feature enables DDM-2000 to operate in networks that include CMISE-based NEs which may not support TARP propagation.

DDM-2000's compatibility with Tellabs *TITAN* * 5500/S R5.0 DCS, with *TITAN* serving as the TL1/X.25 GNE for DDM-2000 TL1-RNEs, has been confirmed through cooperative joint testing. DDM-2000's compatibility with some other-vendor NEs has also been tested by independent third-parties such as Bellcore.

Because DDM-2000 OC-12 R7.0 is intended to facilitate OS-based centralized operations, and because TL1/X.25 OS access is the key standardized multi-vendor OI application, the following Remote NE Status features are not supported in DDM-2000 OC-12 R7.0:

- Remote office alarms
- Remote CIT alarm reports
- Remote user panel indications
- TBOS
- Parallel telemetry.

All of the above features depend on the proprietary exchange of information among Lucent NEs in a subnetwork, specifically the communication of each remote NE's alarm status to other NEs. Although the Remote NE Status features were supported in previous releases of DDM-2000, such Lucent-only operations features in multi-vendor subnetworks would not include other-vendor NEs, due to the lack of applicable standards, and thus would be incomplete.

* *TITAN* is a trademark of Tellabs, Inc.

Safety Instructions

Product Safety Labels

Important safety instructions are in this manual. In addition to the instructions on the following page there are other safety instructions you must follow. These instructions involve lasers, lightwave optical cable and connectors, and precautions when handling circuit packs to prevent damage from electrostatic discharge. This manual also contains admonishments in the form of ***DANGERS***, ***WARNINGS***, and ***CAUTIONS*** which must be followed at all times.

These admonishments have the following definitions:

- ***DANGER*** indicates the presence of a hazard that *will* cause death or severe personal injury if the hazard is not avoided.
- ***WARNING*** indicates the presence of a hazard that *can* cause death or severe personal injury if the hazard is not avoided.
- ***CAUTION*** indicates the presence of a hazard that *will* or *can* cause minor personal injury or property damage if the hazard is not avoided. The caution is also used for property-damage-only accidents. This includes equipment damage, loss of software, or service interruption.

Other important safety instructions that you should read are in the "Operation and Maintenance" section of this manual. Only trained personnel should perform the procedures in that section.

The alert symbol • appears throughout this product and in this manual to alert the user to the presence of important operating and maintenance (servicing) instructions for the DDM-2000 OC-12 Multiplexer.

Lightwave Safety Guidelines

General Laser Information

Lightwave/lightguide systems, their associated test sets, and similar operations systems (OS) use semiconductor laser transmitters that emit light at wavelengths between approximately 800 nanometers and 1600 nanometers. The emitted light is above the red end of the visible spectrum, which is normally not visible to the human eye. Although radiant energy at near-infrared wavelengths is officially designated invisible, some people can see the shorter wavelength energy even at power levels several orders of magnitude below any that have been shown to cause injury to the eye.

Conventional lasers can produce an intense beam of monochromatic light. The term monochromaticity means a single wavelength output of pure color that may be visible or invisible to the eye. A conventional laser produces a small-size beam of light, and because the beam size is small the power density (also called irradiance) is very high. Consequently, lasers and laser products are subject to federal and applicable state regulations as well as international standards for their safe operation.

A conventional laser beam expands very little over distance or is said to be very well collimated. Thus, conventional laser irradiance remains relatively constant over distance. However, lasers used in lightwave systems have a large beam divergence, typically 10 to 20 degrees. Here, irradiance obeys the inverse square law (doubling the distance reduces the irradiance by a factor of 4) and rapidly decreases over distance.

Lasers and Eye Damage

Light energy emitted by laser and high-radiance LEDs in the 400-1400nm range may cause eye damage if absorbed by the retina. When a beam of light enters the eye, the eye magnifies and focuses the energy, magnifying the irradiance. The irradiance of energy that reaches the retina is approximately 10^5 or100,000 times that at the cornea; and if sufficiently intense, may cause a retinal burn.

The damage mechanism at the wavelengths used in telecommunications is thermal in origin (that is, damage caused by heating). Therefore, a specific amount of energy is required for a definite time to heat an area of retinal tissue. Damage is not instantaneous. It occurs only when one looks at the light sufficiently long that the product of the retinal irradiance and the viewing time exceeds the damage threshold. Light energies above 1400 nm would cause surface and skin burns and do not affect the retinal area.

Classification of Lasers

Manufacturers of lasers and laser products in the U.S. are regulated by the Food and Drug Administration's Center for Devices and Radiological Health (FDA/CDRH) under 21 CFR 1040. These regulations require manufacturers to certify each laser or laser product as belonging to one of four major Classes — Class I, II, IIa, IIIa, IIIb, or IV. Lasers are classified according to the accessibly emission limits and their potential for causing injury. Lightwave systems are generally classified as Class I, because, under normal operation conditions, all energized laser transmitting circuit packs are terminated on optical fibers which enclose the laser energy with fiber sheath, forming a protective housing. Also, covers are in place over the circuit pack shelves.

Lightwave Safety Precautions

In its normal operating mode, a lightwave system is totally enclosed and presents no risk of eye injury. It is a Class I system under the FDA/CDRH scheme.

The lightguide cables that interconnect various components of a lightwave system can disconnect or break and may expose people to lightwave emission. Also, certain measures and maintenance procedures may expose the technician to emission from the semiconductor laser during installation and servicing. Unlike more familiar laser devices, such as solid-state and gas lasers, the emission pattern of a semiconductor laser results in a highly divergent beam. In a divergent beam, the irradiance (power intensity) decreases rapidly with distance. The greater the distance, the less energy will enter the eye and the less potential risk for eye injury.

Inadvertently viewing an unterminated fiber or damaged fiber with the unaided eye at distances greater than 5 to 6 inches normally will not cause eye injury provided the power in the fiber is less than a few mW at the shorter wavelengths and higher at the longer wavelengths. However, damage may occur if an optical instrument, such as a microscope, magnifying glass, or eye loupe, is used to stare at the energized fiber end.

CAUTION:
Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous laser radiation exposure.

Safety Precautions for Enclosed Systems

Under normal operating conditions, lightwave transmission systems are completely enclosed; nonetheless, the following precautions should be observed:

1. Because of the potential for eye damage, technicians should neither disconnect any lightwave cable nor splice and stare into the optical connectors terminating the cables.
2. Under no circumstances shall lightwave/lightguide operations be performed by a technician before satisfactorily completing an approved training course.
3. Since viewing lightwave emission directly with an optical instrument, such as an eye loupe, greatly increases the risk of eye damage, an appropriate label must appear in plain view on the front of the main frame or lightguide termination/interconnection equipment. The label shall read as follows:

   NOTICE: UNTERMINATED OPTICAL CONNECTORS MAY EMIT LASER RADIATION. AVOID DIRECT EXPOSURE TO THE BEAM. DO NOT VIEW THIS BEAM WITH OPICAL INSTRUMENTS.

Safety Precautions for Unenclosed Systems

During service, maintenance, or restoration, a lightwave transmission system is considered unenclosed. Under these conditions, follow these practices:

1. Only authorized, trained personnel shall be permitted to do service, maintenance, and restoration. Avoid exposing the eye to emissions from unterminated, energized optical connectors at close distances. Connectors associated with lightwave regenerators are recessed, which limits exposure distance. However, technicians removing or replacing regenerators should not stare or look directly into the vacant regenerator slot with optical instruments or magnifying lenses. (Normal eyewear or indirect viewing instruments, such as a FIND-R-SCOPE*, are not considered magnifying lenses or optical instruments.)*
2. Only authorized, trained personnel shall use the lightwave test equipment during installation or servicing, since this equipment contains semiconductor lasers. (Some examples of lightguide test equipment are OTDR's, Hand-Held Loss Test Sets, and Feature Finders.)
3. Under no circumstances shall any personnel scan a fiber with an optical test set without verifying that all lightwave sources on the fiber are turned off.
4. All unauthorized personnel shall be excluded from the immediate area of lightwave transmission systems during installation and service.

Consult *ANSI* † Z136.1 American National Standard for Safe Use of Lasers for guidance on the safe use of lasers in the workplace.

Electrostatic Discharge (ESD) Considerations

CAUTION:
Industry experience has shown that all integrated circuit packs can be damaged by static electricity that builds up on work surfaces and personnel. The static charges are produced by various charging effects of movement and contact with other objects. Dry air allows greater static charges to accumulate. Higher potentials are measured in areas with low relative humidity, but potentials high enough to cause damage can occur anywhere.

* Registered trademark of F. J. W. Industries, Inc.

† ANSI is a registered trademark of American Standards Institute, Inc.

The following precautions should be observed when handling circuit packs in order to prevent damage by ESD:

- Assume all circuit packs contain solid state electronic components that can be damaged by ESD. Use only Lucent Technologies' manufactured recognized circuit packs in this system. Recognized circuit packs are listed in this user/service manual.
- When handling circuit packs (storing, inserting, removing, etc.) or when working on the backplane, always wear a grounded wrist strap or wear a heel strap and stand on a grounded, static-dissipating floor mat. If a static-dissipating floor mat is used, be sure that it is clean.
- Handle all circuit packs by the faceplate or latch and by the top and bottom outermost edges. Never touch the components, conductors, or connector pins.
- Observe warning labels on bags and cartons. Whenever possible, do not remove circuit packs from antistatic packaging until ready to insert them into slots.
- If possible, open all circuit packs at a static-safe work position using properly grounded wrist straps and static-dissipating table mats. If a static-dissipating table mat is used, be sure that it is clean.
- Always store and transport circuit packs in static-safe packaging. Shielding is not required unless specified.
- Keep all static-generating materials, such as food wrappers, plastics, and *Styrofoam*[*] containers, away from all circuit packs. Upon removal from the bay, immediately put circuit packs into static-safe packages.
- Whenever possible, maintain relative humidity above 20 percent.

* Registered trademark of The Dow Chemical Company.

To reduce the possibility of ESD damage, shelves are equipped with grounding jacks to enable personnel to ground themselves using wrist straps (see Figure A) while handling circuit packs or working on a shelf(s). The jacks for connection of wrist straps are located at the lower right-hand corner of each shelf and are labeled. When grounding jacks are not provided, an alligator clip adapter enables connection to bay frame ground.

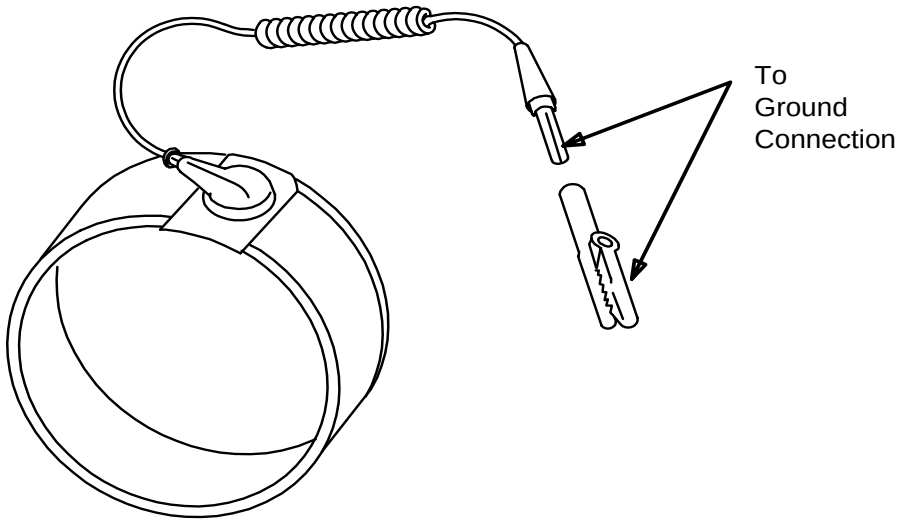


Figure A. Static Control Wrist Strap

IMPORTANT SAFETY INSTRUCTIONS

1. Read and understand all instructions.
2. Follow all warnings and instructions marked on the product.
3. Do not place this product on an unstable cart, stand, or table. The product may fall, causing serious damage to the product.
4. Slots and openings in this product's back or bottom are provided for ventilation. To protect it from overheating, these openings must not be blocked or covered. This product should not be placed in a built-in installation unless proper ventilation is provided. For information on proper ventilation requirements, consult the "Equipment Installation Considerations" section of 363-206-208, *DDM-2000 OC-12 Multiplexer Installation Manual*.
5. This product should be operated only from the type of power source indicated on the marking label. For information on proper electrical distribution and power requirements, refer to the "Power" and "Technical Specifications" sections of this user/service manual.
6. Never push objects of any kind into this product through cabinet slots as they may touch dangerous voltage points or short out parts that could result in a risk of fire or electrical shock. Never spill liquid of any kind on the product.
7. To reduce the risk of electrical shock, do not disassemble this product. Service should be performed by trained personnel only. Opening or removing covers and/or circuit packs may expose you to dangerous voltages or other risks. Incorrect reassembly can cause electrical shock when the unit is subsequently used.
8. ***Caution: Disconnect two (2) power connections when removing power from the system.***
9. Use only Lucent Technologies' manufactured UL recognized circuit packs in this system. Recognized circuit packs are listed in this user/service manual.

SAVE THESE INSTRUCTIONS.

IMPORTANT INSTALLATION SAFETY INSTRUCTIONS

1. Read and understand all instructions.
2. Installation and maintenance procedures must be followed and performed by trained personnel only.
3. All DS3 interfaces should not leave the building premises unless connected to telecommunication devices providing primary or secondary protection, as applicable.
4. For information on proper mounting instructions, consult 363-206-208, *DDM-2000 OC-12 Multiplexer Installation Manual*.
5. Never install telecommunication wiring during a lightning storm.
6. Never install telecommunication connections in wet locations.
7. Never touch uninsulated telecommunication wires or terminals unless the telecommunication line has been disconnected at the DS3 interface.
8. Use caution when installing or modifying telecommunication lines.

SAVE THESE INSTRUCTIONS.

Related Documentation

The following documents provide additional information about the DDM-2000 Multiplexers:

- Number: 365-576-130 (User Manual only) Release 7.0
  Number: 365-576-131 (User Manual & Software) Release 7.0

  Title: *CPro-2000 User Manual*

  Audience: Maintenance personnel

  Content: Using the tool to provision and maintain ring networks

- Number: 363-206-200

  Title: *DDM-2000 OC-3 and OC-12 Multiplexers Applications, Planning, and Ordering Guide*

  Audience: Network planners, equipment engineers, and sales teams

  Content: Features, applications, high-level description, operations, administration, maintenance, and provisioning (OAM&P), system planning, ordering, product support, reliability information, technical specifications, and a synchronous optical network (SONET) overview.

- Number: 363-206-201

  Title: *DDM-2000 OC-3 Multiplexer, System Commands Quick Reference*

  Audience: Maintenance personnel

  Content: Abbreviated list of system commands and parameters for DDM-2000 OC-3 Multiplexers through Release 7.2

- Number: 363-206-204

  Title: *DDM-2000 OC-3 Multiplexer Installation Manual*

  Audience: Customers planning to install the equipment

  Content: Customer installation instructions

- Number: 363-206-206

  Title: *DDM-2000 OC-12 Multiplexer — System Commands Quick Reference*

  Audience: Maintenance personnel

  Content: Abbreviated list of system commands and parameters for DDM-2000 OC-12 Multiplexers through Release 3.1

- Number: C107564270

  Title: *ITM SNC Users Guide*

  Audience: Operations personnel

  Content: Integrated Transport Management Subnetwork Controller information.

- Number: 363-206-207

  Title: *DDM-2000 OC-12 Multiplexer and OC-12 Regenerator User/Service Manual*

  Audience: Maintenance personnel

  Content: Detailed description, technical specifications, commands and reports, and operations and maintenance procedures for DDM-2000 OC-12 Multiplexers through Release 3.1 and OC-12 Regenerator through Release 2.0.

- Number: 363-206-208

  Title: *DDM-2000 OC-12 Multiplexer Installation Manual*

  Audience: Customers planning to install the equipment

  Content: Customer installation instructions

- Number: 363-206-220

  Title: *DDM-2000 OC-3/OC-12 Multiplexer Circuit Pack Options Job Aid*

  Audience: Maintenance personnel

  Content: List of circuit pack options

- Number: 363-206-222

  Title: *DDM-2000 OC-3/OC-12 Multiplexer Acceptance Task List Job Aid*

  Audience: Maintenance personnel

  Content: Checklist of acceptance and turnup procedures

- Number: 363-206-223

  Title: *DDM-2000 OC-12 Regenerator — System Commands Quick Reference*

  Audience: Maintenance personnel

  Content: Abbreviated list of system commands and parameters

- Number: 363-206-281

  Title: *DDM-2000 OC-3 Multiplexer — System Commands Quick Reference*

  Audience: Maintenance personnel

  Content: Abbreviated list of system commands and parameters for DDM-2000 OC-3 Multiplexers, Releases 8.0 and 9.0

- Number: 363-206-285

  Title: *DDM-2000 OC-3 Multiplexer User/Service Manual, Volumes I and II*

  Audience: Maintenance personnel

  Content: Detailed description, technical specifications, commands and reports (Volume I), and operations and maintenance procedures (Volume II) for DDM-2000 OC-3 Multiplexer Release 13.0.

- Number: 363-206-291

  Title: *DDM-2000 OC-12 Multiplexer — System Commands Quick Reference*

  Audience: Maintenance personnel

  Content: Abbreviated list of system commands and parameters for DDM-2000 OC-12 Multiplexers, Release 5.x

- Number: 363-206-300

  Title: *DDM-2000 FiberReach Multiplexer Applications, Planning, and Ordering Guide*

  Audience: Network planners, equipment engineers, and sales teams

  Content: Features, applications, high-level description, operations, administration, maintenance, and provisioning (OAM&P), system planning, ordering, product support, reliability information, technical specifications, and a synchronous optical network (SONET) overview

- Number: 363-206-305

  Title: *DDM-2000 FiberReach Multiplexer Wideband/Narrowband TARP Shelf User/Service Manual*

  Audience: Maintenance personnel

  Content: Detailed description, technical specifications, and O&M procedures for the DDM-2000 FiberReach Multiplexer Wideband Shelf

- Number: 363-206-310

  Title: *DDM-2000 FiberReach Multiplexer Installation Manual*

  Audience: Users planning to install the equipment

  Content: Customer installation instructions

- Number: 824-102-144

  Title: *Lucent Technologies 2000 Product Family Multi-Vendor Operations Interworking Guide*

  Audience: System planners and engineers

  Content: Operations interworking information for the Lucent Technologies Product Family 2000 systems, including DDM-2000 Multiplexers and FT-2000 OC-48 Lightwave Systems in multi-vendor subnetworks

- Number: 824-102-147

  Title: *Lucent Technologies 2000 Product Family Operations Interworking Guide*

  Audience: System planners and engineers l

  Content: Operations interworking information for the Lucent Technologies Product Family 2000 systems, including DDM-2000 Multiplexers and FT-2000 OC-48 Lightwave System

- Number: 824-102-151

  Title: *DDM-2000 Multiplexers Operations Systems Engineering Guide*

  Audience: Engineers

  Content: Operations systems engineering information for the DDM-2000 Multiplexers

- DDM-2000 OC-3 Drawings:

ED-8C724-10 OC-3 and OC-3/OC-12 Combined Bay Arrangements
ED-8C724-15 Cabling Plan (Rear Access)
ED-8C724-16 Cabling Plan (Front Access)
ED-8C724-20 Cable Assemblies
ED-8C724-21 Cable Assemblies
ED-8C724-30 DDM-2000 Shelf Assembly
ED-8C724-31 User Panel Assembly
ED-8C724-34 Releases 2 and 3 Software Ordering
ED-8C724-36 Release 5 Software Ordering
ED-8C724-37 Release 6 Software Ordering
ED-8C724-38 Release 7 Software Ordering
ED-8C724-39 Release 8 Software Ordering
ED-8C724-40 Release 9 Software Ordering
ED-8C733-30 Fan, Filter, and Baffle Assemblies
SD-7C510-01 Application Schematic
T7C510-31 Interconnect Wiring (Rear Access)
T7C510-32 Interconnect Wiring (Front Access)
801-525-168 Floor Plan Data Sheets

- DDM-2000 OC-12 Drawings:

ED-8C724-10 OC-3 and OC-3/OC-12 Combined Bay Arrangements
ED-8C727-10 Typical Bay Arrangements
ED-8C727-15 Cabling Plan (Rear Access)
ED-8C727-16 Cabling Plan (Front Access)
ED-8C727-20 Cable Assemblies
ED-8C727-21 Cable Assemblies
ED-8C727-30 Shelf Assembly
ED-8C727-31 User Panel Assembly
ED-8C727-34 DDM-2000 OC-12 Release 2 Software Ordering

ED-8C724-10	OC-3 and OC-3/OC-12 Combined Bay Arrangements
ED-8C727-35	DDM-2000 OC-12 Release 3 Software Ordering
ED-8C727-36	DDM-2000 OC-12 Release 5 Software Ordering
ED-8C727-41	DDM-2000 OC-12 Regenerator Release 2 Software Ordering
SD-7C513-01	Application Schematic
T7C513-31	Interconnect Wiring Diagram (Rear Access)
T7C513-32	Interconnect Wiring (Front Access)
801-525-168	Floor Plan Data Sheets

DDM-2000 equipment is also available in traditional loop enclosure arrangements, descriptions of which may be found in the following Lucent practices:

- Number: 363-205-000

  Title: *SLC® Series 5 Carrier System Ordering Guide — Loop Transmission Systems* (to be replaced by 363-205-010)

- Number: 363-205-010

  Title: *SLC® Series 5 System Applications and Planning Guide*

- Number: 626-500-105

  Title: *80-Type Cabinets Ordering Information and Lettering Guide*

- Number: 626-500-115

  Title: *90-Type Cabinets Coding and Ordering Information*

The following documents provide additional information about related equipment:

- Number: 363-206-150

  Title: *DDM-Plus User/Service Manual*

- Number: 363-206-151

  Title: *DDM-Plus Installation Manual*

- Number: 363-206-152

  Title: *DDM-Plus Quick Reference Guide*

- Number: 363-206-156

  Title: *DDM-Plus Equipment Engineering and Ordering Guide*

- Number: 363-206-157

  Title: *DDM-Plus Wall DT Installation Manual*

- Number: 365-303-102

  Title: *DSX-3 Cross-Connect Bay, Description, Operation, and Maintenance Manual*

- Number: 365-301-130

  Title: *System III DSX-3/4, Planning, Engineering, Installation, and Operation — System Reference Guide*

- Number: 365-331-000

  Title: *DACS III-2000 Release 2.0 Applications, Planning, and Ordering Guide*

- Number: 365-340-004

  Title: *DACS IV-2000 Release 2.1 Reference Manual*

- Number: 365-575-100

  Title: *FT-2000 OC-48 Lightwave System Applications, Planning, and Ordering Guide*

- Number: 636-299-120

  Title: *LGX® Distribution System, Planning, Engineering, Installation, and Operation System Reference Guide*

- Title: *MegaStar** 2000 Documents

Comcode 107585648	Installation Manual
Comcode 407397512	Schematic Package
Comcode 107585655	Reference Manual
Comcode 107585671	System Application Manual

* Trademark of Harris Corporation.

Related Training

The National Product Training Center at Dublin, Ohio, and Lisle, Illinois, provides management courses for planning, engineering, and ordering, as well as training for telecommunications technicians in installation, operations, and maintenance. Suitcasing of these courses is available. Consult your local Lucent Technologies' Account Executive for more information or reservations. Call **1-888-LUCENT8 (1-888-582-3688), prompt 2** for enrollment.

The following courses are provided by the National Product Training Center:

- Number: LW2211 (CD-ROM)

  Title: DDM-2000 OC-3/OC-12 Multiplexer Fundamentals

  Audience: A CD-ROM-based course for anyone interested in learning the fundamentals of operation of the DDM-2000 OC-3/OC-12 Multiplexers

  Content: General information about the DDM-2000 OC-3 and OC-12 Multiplexers, including a product overview, applications, and architecture

- Number: LW2212

  Title: DDM-2000 OC-3 and OC-12 Multiplexer Applications and Architecture

  Audience: Fundamental planners, account executives, and private telecommunications network technical consultants

  Content: General information about the DDM-2000 OC-3 and OC-12 Multiplexers including a product overview, applications, architecture, and deployment planning. This course is a prerequisite for LW2312.

- Number: LW2312

  Title: DDM-2000 OC-3 and OC-12 Multiplexer Equipment Engineering and Planning

  Audience: Facility planners, outside plant engineers, central office equipment engineers, and private network design engineers

  Prerequisite: LW2212

  Content: Information and guidelines required to plan and order DDM-2000 OC-3 and OC-12 Multiplexer equipment for loop feeder and interoffice applications

- Number: LW2604

  Title: DDM-2000 OC-3 Multiplexer Ring/Linear Networks, Operations and Maintenance

  Audience: Technicians, supervisors, maintenance engineers, and operation support personnel involved in day-to-day provisioning and maintenance

  Content: Information supporting operations, maintenance, and provisioning or ring and/or linear DDM-2000 OC-3 Multiplexers. On-site shelves are used for extensive hands-on experience.

- Number: LW2610

  Title: DDM-2000 FiberReach Wideband Shelf, Operations and Maintenance

  Audience: Technicians, supervisors, maintenance engineers, and operation support personnel involved in DDM-2000 FiberReach network functions

  Prerequisite: LW2212, LW2312, LW2603, or LW2608

  Content: Information supporting operations, maintenance, and provisioning of DDM-2000 FiberReach Wideband Shelf. On-site shelves are used for extensive hands-on experience.

- Number: LW2611

  Title: DDM-2000 FiberReach Multiplexer Release 1.0 Self-Paced Course

  Audience: Technicians, supervisors, maintenance engineers, and operation support personnel involved in DDM-2000 FiberReach network functions

  Prerequisite: LW2212, LW2312, LW2603, or LW2608

  Content: Information supporting system engineering and planning, applications, operations, maintenance, and provisioning of DDM-2000 FiberReach networks

- Number: LW2612

  Title: DDM-2000 OC-12 Multiplexer Operations and Maintenance

  Audience: Technicians, supervisors, maintenance engineers, and operation support personnel involved in day-to-day provisioning and maintenance

  Content: Information supporting operations, maintenance, and provisioning of the DDM-2000 OC-12 Multiplexer. Includes information on DDM-2000 OC-12 linear and ring applications. On-site shelves are used for extensive hands-on experience.

- Number: LW2614

  Title: 2000 Product Family Surveillance and Performance Monitoring

  Audience: Technicians, supervisors, maintenance engineers, and operation support personnel involved in day-to-day provisioning and maintenance

  Content: Information supporting operations interfaces using X.25 links to an operations center

- Number: LW2618

  Title: Advanced Ring Network Applications, Operations, and Maintenance

  Audience: Technicians, supervisors, maintenance engineers, and operation support personnel involved in day-to-day operations of FT-2000 and/or DDM-2000 OC-3/OC-12 rings having dual ring interworking (DRI) traffic

  Prerequisites: LW2608 and LW2616

  Content: Information supporting operations, maintenance, and provisioning of DRI networks. On-site shelves are used for extensive hands-on experience.

Customer Technical Support (CTS)

Customer Technical Support is available through a toll-free technical assistance number. Lucent maintains a highly-skilled, multi-tier support structure consisting of regional engineers, product specialists, and system designers to support your network equipment. All levels of technical expertise may be called upon to solve the customer problem.

The CTS organization provides remote, diagnostic support. On-site assistance is available on a billable contract or time and material basis. Support services may include the following activities:

- Responding to all requests for assistance
- Tracking and maintaining visible ownership of all reported problems, from inception through resolution
- Analyzing and diagnosing reported problems
- Providing restoration and recovery service
- Providing preventive and/or circumvention measures
- Communicating the actions, plans, and problem status to the reporting customer
- Initiating action to establish Modification Requests (MRs) for design issues
- Writing and distributing technical bulletins (Urgent Problem Notification).

CTS services are available on a contract basis in three levels to meet varying customer needs: Preferred, Standard, and Basic Agreements. The Preferred level of support guarantees 24 x 7 (24 hour, 7 day-a-week) coverage of the customer's network. Guaranteed performance commitments for response, service restoration, and problem resolution times are validated by published Service Performance Reports. The Standard level of support guarantees 8 x 5 (8 hour, 5 day-a-week) coverage. Performance commitments are also validated by Service Performance Reports. Out-of-hours support is available for an additional fee. The Basic level of support guarantees
8 x 5 coverage with hourly billing for each support call. Out-of-hours coverage is available with additional fees.

When the customer experiences a problem, the initial point of contact within Lucent is the Regional Technical Assistance Center (RTAC). RTAC is divided into three regions covering North America: region East (includes Canada), region South, and region West. They can be reached by calling 1-800-CAL-RTAC (1-800-225-7822). Lucent works with the customer to define the problem and determine its severity. Problems are worked during the customer's contracted coverage period. By prior agreement, service-affecting problems are worked immediately regardless of contracted coverage with billing reconciliation if required. Acting as a

single point of contact with the customer, the RTAC engineer will involve all necessary tiers of support to solve the customer problem.

The CTS organization has also established a dial-up technical support medium called COACH. COACH is a system of on-line support tools aimed at providing product news and bulletins, diagnostic services, compatibility information, and on-line documents. COACH tools provide you with the most up-to-date product information so that problems are either prevented or quickly resolved. Many Lucent Technologies transmission products, including DDM-2000 Multiplexers, are supported by COACH.

Once logged into COACH, the user specifies which product to access, and COACH grants the appropriate combination of tools and commands. The user reaches each one of these tools and commands through a centralized, menu-driven computer program. Every screen provides help in making appropriate menu selections. COACH users will achieve proficiency quickly because of the consistency of menu selections among products.

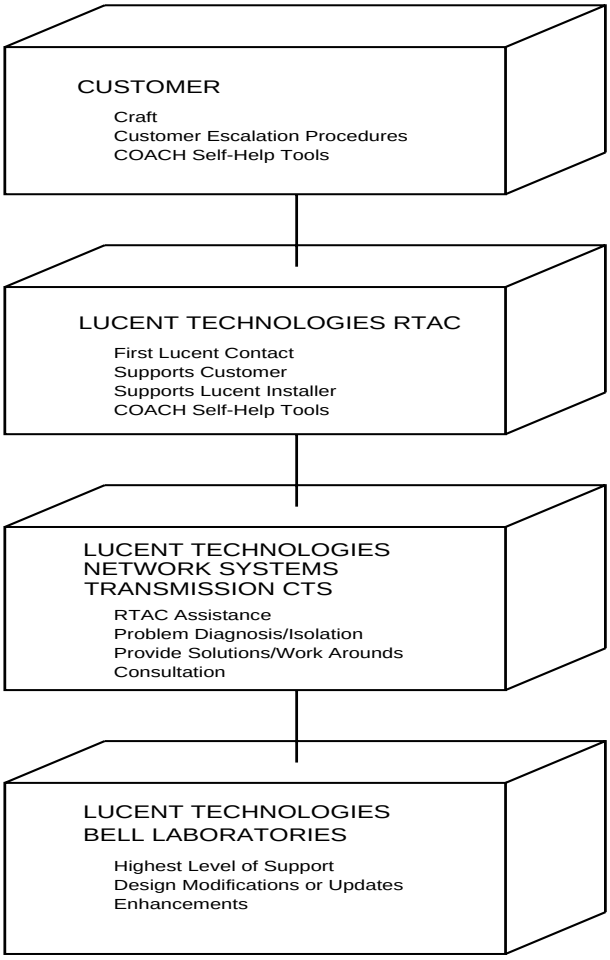


Figure B. Product Support

The following COACH tools are available to the user:

- Diagnostic Dictionary

  The diagnostic dictionary contains histories of previously encountered problems and descriptions of the solutions or workarounds. Your support staff can use this tool when published documentation or standard diagnostic procedures fail to address a problem.

- News and Bulletins

  Immediately after a user logs into COACH, the News and Bulletins tool displays bulletins containing urgent information related to the user's products. All users are automatically notified about urgent matters, such as problems with scheduled releases, recalls of hardware or software, or scheduled maintenance for computer support. Less urgent messages are distributed through news items that can be sent to individuals or categories of users. Notification of news appears on the screen immediately following current bulletins.

- Compatibility Data

  Occasionally, hardware/software configuration problems arise when new software releases are issued. The Compatibility Data tools permit users to view the correct hardware configuration associated with a specific software release. The user simply enters the appropriate software release number and COACH responds with page-formatted lists of circuit packs compatible with the selected software release. This tool also contains the latest issue numbers of the customer documentation.

- COACH User's Guide

  COACH supplies an on-line version of its User's Guide. The COACH User's Guide includes instructions on using the customer support tools and documents any changes to the previous version of the guide.

For information on obtaining a COACH login, contact:

COACH Software Development
Lucent Technologies
1600 Osgood St.
North Andover, MA. 01845

Telephone: **1-800-238-4021**

The RTAC and CTS organization strive to provide proactive and responsive technical customer support for all its products. Through the combined efforts of the individual customer support groups and through COACH tools, the RTAC and CTS organization provide the best possible customer support.

Engineering and Installation Services

The Lucent Technologies Customer Support and Operations (CS&O) organization provides customers with quality product support services. Whether you need assistance in engineering, installation, normal system maintenance, or disaster recovery, the support staff provides you with the quality technical support you need to get your job done. Each segment of the CS&O organization regards the customer as its highest priority and understands your obligation to maintain quality service for your customer.

Within the CS&O organization, the Engineering and Installation Services group provides a highly skilled force of support personnel to provide customers with quality engineering and installation services. These engineering and installation specialists use state-of-the-art technology, equipment, and procedures to provide customers with highly competent, rapid response services. These services include analyzing your equipment request, preparing a detailed specification for manufacturing and installation, creating and maintaining job records, installing the equipment, and testing and turning over a working system.

When the CS&O organization provides job records and installs the equipment, operationally affective changes to the system are automatically identified and applied to the system at no additional cost.

The Engineering and Installation Services group provides the customer with an individually tailored, quality-tested job that meets our published high standards and the customer's operational requirements. The group ensures that the customer's system order is integrated into a complete working system tailored to office conditions and preferences. This process provides for the customer's complete needs. It includes provisions for cabling, lighting, power equipment, and ancillary connections to local and/or remote alarm systems. The group will also respond to any customer changes that occur during installation.

All equipment engineered and installed by Lucent is thoroughly tested and integrated into a reliable system at cutover. Once approved by Lucent's Quality Assurance Test group, the system is turned over to the customer.

The group also provides any specialized engineering and installation services required for unusual or highly individualized applications. These services may include engineering consultations and database preparation. Your local Account Executive can provide more information about these services.

Customer Technical Support Enhanced Services

The goal of Lucent Technologies' Customer Technical Support Enhanced Services is to keep Lucent Transmission Systems' products operating at maximum performance and to prevent problems from interrupting service to customers.

Typical Enhanced Services include:

- Network design, growth planning, and performance analysis
- Multivendor troubleshooting
- Network integration
- Preventive and remedial maintenance
- Hardware and software upgrade services
- On-site maintenance programs
- Customized MOP (Method of Procedure) development.

For more information on Lucent's Customer Technical Support Services, contact your Lucent Technologies' Account Executive.

Documentation Support

The Lucent Technologies Customer Training and Information Products organization provides a contact to report errors or to ask questions about information in this document. The document support telephone number is **1-888-LTINFO6 (1-888-584-6366)** (Monday through Friday, 8:00 a.m. to 4:00 p.m. EST).

How to Order Documents

To order additional copies of this document and/or request placement on the standing order list, send or call in an order as follows:

Customer	Mail Order	Telephone Order *(Monday through Friday)*
Commercial Customers *	Lucent Technologies Customer Information Center Attention: Order Entry Section 2855 N. Franklin Road P.O. Box 19901 Indianapolis, IN 46219	Within USA: 1-888-LUCENT8 **1-888-582-3688** *7:30 a.m. to 6:30 p.m. EST* FAX: **1-800-566-9568** From Europe, The Middle East & Africa: Toll **1-317-322-6416** From Canada, the Caribbean & Latin America: Toll **1-317-322-6646** From Asia, the Pacific Region & China: Toll **1-317-322-6411** Worldwide: FAX: **1-317-322-6699**
RBOC/BOC	Process through your Company Documentation Coordinator	

* For commercial customers, a check, money order, purchase order number, or charge card number is required with all orders. Make checks payable to Lucent Technologies.

Lucent entities should use Form IND 1-80.80 FA, available through the Customer Information Center.

Standing Orders

One-time orders include a binder (if applicable) and the document contents for the current issue in effect at the time of order. Also, you may request placement on the standing order list for all later reissues of the document. The standing order list for each document provides automatic distribution for all reissues of the document. RBOC/BOC customers should process document orders or standing order requests through their Company Documentation Coordinator. For questions regarding standing orders or to be placed on a standing order list, call the applicable Lucent Customer Information Center number listed in “How To Order Documents.”

How to Comment on This Document

Feedback forms are located immediately after the title page of this document. Please fill out the form and return it to the address stamped on the front of the form or fax it to the number provided on the form.

If the feedback forms are missing, send comments on this document to:

Lucent Technologies
Customer Training and Information Products
2400 Reynolda Road
Winston-Salem, NC 27106

You may also report errors or request changes to this document by calling the toll free number, **1-888-LTINFO6 (1-888-584-6366)**, and giving the 9-digit document number.

Electronic Documentation

Documentation for the DDM-2000 OC-12 Multiplexer is now available in electronic form, on compact disk, read-only memory (CD-ROM). CD-ROM has many advantages over traditional paper documentation, including cost savings, search and retrieve capability, and the assurance of the most current documentation.

CD-ROM is available by annual subscription (on standing order).

- To order, call your Technical Information Resource Manager, your Lucent Technologies' Account Executive, or the Lucent Customer Information Center **1-888-LUCENT8 (1-888-582-3688)**.
- For pricing information, contact your Lucent Network Systems Account Executive or the Lucent Customer Information Center **1-888-LUCENT8 (1-888-582-3688)**.

  The CD-ROM Product Line Order Number for the All Access and Transport Products Grouping is 300-100-010.
- For technical information, call Lucent Documentation Support **1-888-LTINFO6 (1-888-584-6366)**.

System Introduction

1

Table of Contents

Overview 1-1

Introduction to the 2000 Product Family 1-1

Introduction to the DDM-2000 OC-12 Multiplexer 1-2

DDM-2000 OC-12 Multiplexer Releases 1-3

- Release Descriptions 1-3

DDM-2000 OC-12 Multiplexer Release 7.0 1-8

- Release Description 1-8

Table of Contents

System Introduction

1

Overview

This section introduces the Lucent Technologies' 2000 Product Family and briefly describes the DDM-2000 OC-12 Multiplexer.

Introduction to the 2000 Product Family

Lucent Technologies is focused on a carefully planned and growing product family designed to provide total network solutions. The family complies with the synchronous optical network (SONET) standard and builds on items that customers have found to be useful and successful in networks such as single-ended maintenance and upgrade capabilities. The 2000 Product Family includes the following products:

- DDM-2000 OC-3 Multiplexer
- DDM-2000 OC-12 Multiplexer
- DDM-2000 FiberReach Multiplexer
- FT-2000 OC-48 Lightwave System
- DACS III-2000 Cross-Connect System
- DACS IV-2000 Cross-Connect System
- ITM XM Controller
- *SLC*®-2000 Access System
- Business Remote Terminal-2000 (BRT-2000)
- ITM SNC Sub-Network Controller.
- CPro-2000

Introduction to the DDM-2000 OC-12 Multiplexer

The DDM-2000 OC-12 Multiplexer is a single shelf SONET digital multiplexer. A single 12-inch shelf supports a mix of digital signal 3 (DS3), electrical carrier 1 (EC-1), and optical carrier level 3 (OC-3) signals and multiplexes them into a SONET standard 622 Mb/s optical carrier level 12 (OC-12) rate.

The OC-12 and OC-3 optical lines, all transmission-affecting circuit packs, and the –48 V DC power feeders may be optionally protected. The shelf can be equipped to serve many diverse network applications and supports a variety of operations interfaces for current and evolving network operations needs.

The DDM-2000 OC-12 Multiplexer is designed for loop (access), interoffice (transport), and customer location applications. The DDM-2000 OC-12 Multiplexer starts with many of the proven features of Lucent Technologies' DDM-1000 and DDM-2000 OC-3 Multiplexers and extends into the future with the flexibility of the SONET standard.

The DDM-2000 OC-12 Multiplexer is designed for easy installation and operation. Installation is simplified with integrated test capabilities and default provisioning. Centralized operation is supported by a full set of single-ended control and maintenance features. Built-in maintenance capabilities support both installation and system operation. A DDM-2000 OC-12 Multiplexer can be fully tested and installed without using external test equipment. Some tasks can be performed using faceplate light-emitting diode (LED) displays and controls, while a craft interface terminal (CIT) gives access to sophisticated maintenance, provisioning, and reporting features. A personal computer (PC) is needed to download software and to run CPro-2000 graphical user interface tool software.

The OC-12 Regenerator extends the span length of the DDM-2000 OC-12 Multiplexer and is supported in both unbalanced and balanced modes. Diverse routing is supported in either mode, allowing one line to travel over a longer route than the other. The OC-12 Regenerator uses the same shelf and some of the same circuit packs as the OC-12 Multiplexer. See 363-206-207, "DDM-2000 OC-12 Multiplexer and OC-12 Regenerator User/Service Manual" for more information on the OC-12 Regenerator.

The DDM-2000 OC-12 Multiplexer has a phased release plan. This manual has been issued to introduce Release 7.0 and will be updated to cover additional releases as they become available.

DDM-2000 OC-12 Multiplexer Releases

Release Descriptions

The following paragraphs provide brief descriptions of the DDM-2000 OC-12 Multiplexer releases:

Release 1.0 and later features include OC-12 point-to-point with DS3 low-speed interfaces, OC-12 hubbing with OC-3 extensions, and OC-3/OC-12 interworking using the 21D optical line interface unit (OLIU). The TL1/X.25 message-based interface to Bellcore's Network Monitoring and Analysis (NMA) operations system feature comes as part of the controller hardware and separately ordered software required with Release 1.1 and later equipment. Hardware features include the 21D OLIU, which provides a short-reach multimode proprietary optical interface (IS-3) between the OC-3 and OC-12 shelves and the BBF2B TGS circuit pack, which provides DS1 timing outputs. Release 1.0 includes a security feature that offers security against unauthorized access to the CIT system functions. Logins, passwords, and user categories are provided. Security can be enabled or disabled.

Release 2.0 new features include OC-3/OC-12 interworking using the open systems interconnection (OSI) 7-layer protocol stack over the data communications channel (DCC). The OSI 7-layer protocol stack refers to the OSI reference model, a logical structure for network operations standardized by the International Standards Organization (ISO). Release 2.0 also includes optical carrier level 3 concatenated (OC-3c) transport. This OC-3c transport feature can be used to interface with broadband terminals using 21D or 21G OLIUs.

SONET synchronization messaging is used to communicate the quality of network timing, internal timing status, and timing states throughout a subnetwork. The OC-12 23H/23H-U OLIU provides 1550 nm optics for long reach (100 km) central office applications.

Release 2.1 new applications include DDM-2000 OC-12/DACS IV-2000 transmission interworking with an EC-1 interface, DDM-2000 OC-12/FT-2000 OC-48 Lightwave System transmission interworking with an EC-1 interface, and OC-12 linear extensions from OC-3 rings. New features include an EC-1 interface with a new BBG12 3STS1E low-speed interface circuit pack, TL1 interface to Bellcore's Operations Systems/Intelligent Network Elements (OPS/INE) Release 1.7, and additional TL1 messages to support provisioning, maintenance, testing, performance monitoring, and security functions.

Release 2.2 new applications and features include interworking with *SLC*-2000 Release 3.0, channel state provisioning, and additional TL1 commands and enhancements.

Channel state provisioning is a capability provided on DDM-2000 OC-12 Multiplexers that suppresses reporting of alarms and events by supporting multiple states (automatic [AUTO], in-service [IS], and not monitored [NMON]) for STS-1 channels.

Release 2.3 provides OC-3 line state provisioning in addition to the features of Release 2.2. Line state provisioning allows in-service and not-monitored states of OC-3 line level alarms on Function Unit OLIUs. The alarms can be squelched and removed from the alarm report. Used in one-way OC-3c transport on OC-12 video applications.

Release 3.0 is an OC-12 STS-1 path switched ring release featuring EC-1 dual ring interworking (DRI) with drop and continue and automatic synchronization reconfiguration. New applications include OC-12 path switched ring, DDM-2000 OC-12/DACS IV-2000 transmission interworking, and DRI interworking via an EC-1 interface. New features include DS3 low-speed interface on an OC-12 path switched ring, EC-1 low-speed interface with the BBG12 3STS1E circuit pack, two-fiber path switched ring, ten network elements' maximum network from a single maintenance point, STS-1 drop and continue, nonrevertive protection switching, automatic ring synchronization reconfiguration, OSI 7-layer protocol stack on the DCC in a ring, DS1 timing outputs for timing distribution, synchronization messaging, STS-1 signal degrade, manual STS path switching, enhanced security, remote and remote software download. The new BCP3 time slot interchange (TSI FLEX) circuit pack provides flexible STS-1 bandwidth management across the entire OC-12.

Release 3.1 new applications and features include interworking with *SLC*-2000 Releases 3.1 and 3.2 ring networks, OC-12 STS-1/VT1.5 path switched ring (ring 0x1 low-speed interface) optical interconnections between DDM-2000 OC-3 and OC-12 ring shelves (OC-3/IS-3), enhanced DS3 PM, channel state provisioning, OC-3 ring to OC-12 ring in-service upgrades, low-speed EC-1 loopbacks, and additional TL1 commands and enhancements.

The OC-12 STS-1/VT1.5 path switched ring (ring 0x1 low-speed interface) OC-3/IS-3 interface offers a significant advantage over the 1+1 protected OC-3/IS-3 interface for VT1.5 path switched ring applications. Ring (0x1) low-speed interface means two service lines (no protection lines) are used between the OC-12 Multiplexer ring and the OC-3 Multiplexer ring.

Ring 0x1 low-speed interfaces provide full VT protection switching via an OC-12 ring, bandwidth conservation, and VT bandwidth management on the OC-12 ring.

Enhanced DS3 PM provides a collection (from the fiber or high-speed interface) of the DS3 parity-bit (P-Bit) and frame and multiframe (F&M) bit errored seconds, severely errored seconds, and unavailable seconds to the already provided coding violations and severely errored frame seconds. The feature is mainly used for DS3 tariff verification.

Channel state provisioning is a capability provided on DDM-2000 OC-12 Multiplexers that suppresses reporting of alarms and events by supporting multiple states (AUTO, IS, and NMON) for STS-1 channels.

Electronic STS-1 loopbacks (EC-1 low-speed) are provided to loop each of the three internal STS-1 signals back toward the transmit fiber. These can be used to test a new span being added to a hub or add/drop network.

Release 5.0 is a ring release using the new BBG8 system controller and BCP4 overhead controller circuit packs.

- New applications:
  - — OC-3/IS-3 DRI with STS-1/STS-3c drop and continue. DDM-2000 and DDM-2000/FT-2000 OC-48 Lightwave System rings can be interconnected over OC-3, IS-3, OC-3c, or IS-3c interfaces with single-ended operations and DCC connectivity. Upgrades from EC-1 DRI to OC-3/IS-3 DRI.
  - — OC-3/OC-3c/IS-3/IS-3c linear optical extensions. 1+1 protected OC-3/OC-3c/IS-3/IS-3c linear optical extensions from OC-12 rings.
  - — OC-3c transport for broadband services.
  - — OC-3 operations interworking with FT-2000 OC-48 Lightwave System. Single-ended operations and DCC connectivity supported over OC-3 interfaces. Requires FT-2000 OC-48 Lightwave System Release 6.0 software.
  - — Dual homing. An OC-3 ring can be dual-homed to two different OC-12 shelves via ring (0x1) low-speed interface interconnections. Full DCC connectivity to the OC-3 ring.
  - — Ring (0x1) low-speed interface to OC-3 multinode ring. OC-3 multinode ring is connected to an OC-12 ring shelf via ring (0x1) low-speed interface interconnection to a single OC-12 Function Unit. Full DCC connectivity to the OC-3 ring.
  - — STS-3c broadcast for video applications.
  - — Increased subnetwork sizes. DDM-2000/*SLC*-2000 subnetworks of 32 network elements (NE). Mixed DDM-2000/*SLC*-2000/FT-2000 OC-48 Lightwave System/OC-3 Release 7.2 subnetworks of 24 to 32 NEs.
- New features:
  - — Multiple Operations System (OS) Gateway Network Element (GNE). In DDM-2000/*SLC*-2000 subnetworks, more than one NE can be physically connected to X.25 allowing OSs to automatically select an alternate GNE in case of primary GNE failure. The feature also allows different GNEs to support different OSs simultaneously.

- Additional X.25 switched virtual circuits. Nine virtual circuits can be provisioned in any combination of switched and permanent virtual circuits for connections to OSs.
- Provisionable X.25 packet size of 128 or 256 bytes.
- Centralized operations over X.25 link. DDM-2000 CIT commands have equivalent TL1 commands. This allows centralized operations of DDM-2000 systems via the TL1/X.25 link as an alternative to CIT commands.
- New controllers. The new BBG8 and BCP4 controller circuit packs provide expanded memory and processing capacity needed to support large networks. Feature enhancements include:
  - Remote software download. Software can be downloaded from a PC connected to a DDM-2000/*SLC*-2000 NE to either the local or remote NEs.
  - Electronic provisioning. Provisionable parameters are set by software, thus reducing the need for DIP switches. CIT baud rate is provisioned automatically via autobaud detection.
  - User assigned RT miscellaneous discretes increased from 15 to 21.
  - Upgrades to the new controllers can be done in service.
- Enhanced PM. Enhancements to DS3 line and path PM to further support tariff verification. Enhanced DS3 PM requires the new BBG11B 3DS3 circuit pack.
- Path switching and channel state provisioning for STS-3c channels.
- Line state provisioning. A capability provided on DDM-2000 OC-12 Multiplexers that suppresses reporting of alarms and events by supporting multiple states (IS and NMON) for OC-3 low-speed interfaces.
- Enhanced security. General- and reports-only users increased from 50 to 100. Lockout of nonprivileged users and log of all login attempts is provided.
- Electrical facility loopbacks. DS3 and EC-1 equipment loopbacks of the incoming low-speed signal back towards the DSX.
- STS path trace. Provided in the J1 byte of the SONET path overhead to verify STS path continuity. The path trace signal is used to verify path continuity by repetitively transmitting a fixed 64 byte length string. The value of the transmit and receive expected path trace signal is provisionable. The value of the provisionable receive expected path trace signal is compared to the actual received path trace signal to verify continuity. This allows "labeling" of STS-1s and retrieval of the path by the "label" (for example, "ABC #1"). STS path trace requires the new BBG11B 3DS3 circuit pack.

- — Provisionable AIS or unequipped conditions. Allows the user to provision, on a per-shelf basis, for either AIS or unequipped signal insertion on a non-cross-connected STS channel.
- — Provisionable line and path AIS alarm levels. Alarm levels can be provisioned on a per-line or per-path basis.
- — Brownout protection. If the voltage to the shelf drops below the safe operating voltage, the system will suspend normal operations and wait for safe operating voltage to return. Assuming a sufficient voltage level, a flashing "L" will be displayed on the system controller (SYSCTL).
- — SYSCTL optical faceplate latch. An optical switch on the BBG8 SYSCTL circuit pack latch causes a suspension of controller operations and an "F" to be displayed on the SYSCTL display when the latch is pulled. Closing the latch causes a controller reset.
- — DS3 failure generates STS path AIS. With the OC-12 shelf provisioned for DS3 DRI, a DS3 failure translates to an STS path AIS to ensure a downstream STS path switch.

Release 5.1 is an enhanced ring release which supports all features of R5.0. In addition, it supports the following:

- New Applications:
  - — Enhanced DS3 Dual Ring Interworking translation of an incoming DS3 failure condition into an STS-1 AIS condition for far-end detection and STS-1 path switching of the failed DS3.
- New Features:
  - — S1 byte Synchronization Messaging. Uses the S1 byte of the SONET overhead to pass timing status information to different nodes in a loop-timed network. Synchronization messaging mode (S1 byte or K2 byte) is provisionable on a per OC-N basis.
  - — Enhanced software download. Provides a software copy capability which allows new software generic to be downloaded to the DDM-2000 system while the current version is still running. When the appropriate command is initiated, the new generic is executed with no disruption of DCC. Execution of the new generic can be scheduled, allowing coordination of cutover of several NEs in the subnetwork.
  - — Fourth level of security. A new maintenance security level, which allows access to Reports and some maintenance activities is provided in addition to the three current levels of privileged, general, and reports-only.
  - — Large networks. Supports DDM-2000 and FiberReach networks of up to 50 nodes.
  - — CPro-2000, ITM SNC support. Release 5.1 is supported by:

    CPro-2000 Releases 5.0 and 6.0, ITM SNC Releases 2.2 and 4.0.

DDM-2000 OC-12 Multiplexer Release 7.0

Release Description

NOTE:
DDM-2000 OC-12 Release 7.0 is NOT compatible with previous releases of DDM-2000 OC-12. Therefore, when upgrading a subnetwork, care should be taken to avoid isolating NEs that have not yet been upgraded to Release 7.0.

The following paragraphs provide brief descriptions of the DDM-2000 OC-12 Multiplexer Release 7.0:

Release 7.0 is an enhanced ring release which supports all features of R5.x. In addition, it supports the following:

- New Applications:
  - — Interworking with Tellabs *TITAN* * 5500/S Release 5.0 Digital Cross-Connect System.
- New Features:
  - — Target ID Address Resolution Protocol (TARP) and Bellcore-compliant 2.6 standard OSI stack for intervendor operations Interworking (OI).
    - Provides for large networks up to 256 NEs via level 1 area provisioning and level 2 routing.
  - — Enhanced software download. Provides a software copy capability allowing compressed files containing the new software generic to be downloaded to the DDM-2000 system. This can be done while the current version is still running without affecting the operation of the system. When the appropriate command is initiated, the new generic is executed. Execution of the new generic can be scheduled (time and date), allowing coordination of cutover of several NEs in the subnetwork.
  - — New IntrAOffice LAN between DDM-2000 and ITM SNC for enhanced software download and OS access.
  - — New stratum 3 timing generator circuit pack (BBF4). The TG3 operates with an internal oscillator of ±4.6 ppm long term accuracy.

* *TITAN* is a trademark of Tellabs, Inc.

— Pointer Justification Count (PJC). This performance monitoring parameter indicates a frequency error in the network or other potential synchronization problem. It provides a threshold crossing alert (TCA) when the STS-1 pointer justification count in a performance bin exceeds a user provisioned threshold value.

— STS-3c locked 0x1 cross-connect.

— CPro-2000, ITM SNC support. Release 7.0 is supported by:

CPro-2000 Release 7.0; ITM SNC Release 5.0.

Applications

2

Table of Contents

Overview 2-1

Introduction 2-2

Network Configurations 2-3

- Path Switched Rings 2-3
  - OC-12 Path Switched Rings 2-6
  - OC-12 STS-1/VT1.5 Path Switched Ring (0x1) 2-12
- Folded Ring 2-13
- OC-3 Ring Transport on OC-12 Point-to-Point 2-14
- Dual Homing 2-15
- Dual Ring Interworking (DRI) 2-15
- OC-3 Linear Optical Extensions from OC-3 and OC-12 Rings 2-22
  - OC-12 Point-to-Point (Folded Ring) 2-24
- 2000 Product Family Interworking 2-26
  - *SLC*-2000 Access System 2-26
  - FT-2000 OC-48 Lightwave System 2-27
- Multi-Vendor OI Applications 2-28

Service Applications 2-29

- Loop Feeder 2-29
- Interoffice Transport 2-29
- Broadband Business Access 2-30
- STS-3c Video Broadcast Application 2-32
- STS-3c Video Application ATM Interface 2-33
- Locked STS-3c (0x1) Broadband Services 2-34
- Teleprotection and Supervisory Control and Data Acquisition (SCADA) Applications 2-36
- Intelligent Vehicle Highway System (IVHS) Applications 2-38

Table of Contents

Applications

2

Overview

The DDM-2000 Multiplexers serve a wide range of service applications in a wide variety of network configurations economically and efficiently. The first part of this section, "Network Configurations," describes some of the network configurations in which the DDM-2000 Multiplexers and related products can be used to provide specific service applications. The second part of this section, "Service Applications," describes some of the many service applications that can be served with DDM-2000 Multiplexers.

Because the DDM-2000 Multiplexers are very flexible, most of the service applications described in the second part of this section can be served with many of the network configurations described in the first part. The particular network configuration used for a particular service application depends on many factors, such as physical locations involved, including cost, mix of multiple services to be provided with a single network, required interconnections to other networks, and other factors.

Introduction

DDM-2000 Multiplexers provide the flexibility required for operation in today's changing telecommunications networks. With topology and capacity upgrades, a DDM-2000 network can be installed with minimum first cost and then easily grown to add new sites and new services. Many DDM-2000 circuit packs are common with other Lucent Technologies 2000 Product Family products, resulting in further savings as the network evolves.

The DDM-2000 OC-3 and OC-12 Multiplexers are also an ideal solution for private network and customer location applications. The DDM-2000 OC-3 and OC-12 Multiplexers comply with electromagnetic compatibility (EMC) requirements per FCC Title 47, Part 15, and safety requirements per UL 1459 for equipment in dedicated equipment rooms. The DDM-2000 Multiplexers also have Canadian Standards Association (CSA) Certification Standard C22.2 No. 225-M90. Standard access node configurations are available in Lucent's 51A, 80-type and 90-type BRT-2000 cabinets. Fiber distribution of DS1 services is supported with the DDM-Plus extension shelf or DDM-2000 FiberReach, which allows mixing of DS1 line repeater interfaces for embedded metallic facilities and protected quad DS1 optical interfaces. DS0 and Integrated Services Digital Network (ISDN) services are supported from the *SLC*®-2000 Access System through copper and fiber distribution.

The DDM-2000 FiberReach Multiplexer is the newest member of the DDM-2000 product family and can be used in all DDM-Plus applications where increased capacity and integrated operations, maintenance, and provisioning features are needed. Only representative DDM-2000 FiberReach Multiplexer applications are included in this section. For more application information, see 363-206-300, *DDM-2000 FiberReach Multiplexer Applications, Planning, and Ordering Guide*.

Network Configurations

This part describes many of the network configurations in which the DDM-2000 Multiplexers can be used. In addition to the configurations specifically described, many other combinations of these network configurations can be used to meet specific application needs.

Path Switched Rings

The need to prevent service outage caused by network failure has created a new class of applications. The 2000 Product Family offers a wide range of self-healing network features that automatically protect against service outage caused by cable cuts and equipment failures, which in turn protect customers and generate increased revenue. These self-healing features include flexible DACS-based restoration with the *ITM XM* controller, FT-2000 OC-48 Lightwave System two- and four-fiber rings, DDM-2000 OC-3 and OC-12 virtual tributary 1.5 (VT1.5) and STS-1 path switched rings, and *SLC*-2000 Access System path switched rings.

DDM-2000 OC-3, *SLC*-2000 Access System, and DDM-2000 OC-12 self-healing rings offer the performance and administrative benefits demonstrated by the successful Lucent FT Series G Ring Diversity Switch. Since the DDM-2000 OC-3 and OC-12 path switched rings operate in an integrated, single-ended fashion, complex network-level coordination is not necessary to restore traffic. This means restoration is faster and more reliable. Furthermore, bandwidth administration and network reconfigurations (for example, adding or deleting nodes) can be easier because path switching does not require special time slot assignment rules.

The DDM-2000 OC-3 and OC-12 VT1.5 or STS-1 path switched rings operate as shown in Figure 2-1(a.). Traffic entering a path switched ring node is sent onto both rotations of the ring. At the receiving node, the signal having the highest integrity (based on SONET path information) is selected and dropped as outgoing traffic. At intermediate nodes, the traffic is "passed-through" without changing the SONET path information. The DDM-2000 OC-3/OC-12's VT1.5/STS-1 Time Slot Interchange (TSI) capabilities make the provisioning of add/drop and pass-through traffic quick and easy.

In addition, the backup and restoral capability of CPro-2000 can be used to significantly reduce the effort and increase the accuracy of installing several complex ring shelves having similar or identical configurations. After manually provisioning the first node, CPro-2000 can be used to make a copy of the configuration. This copy can then be used to quickly and easily configure all of the remaining nodes using the restoral feature of CPro-2000. Using system backup and restoral in this fashion provides a much quicker and less error-prone installation than manual provisioning.

The self-healing nature of the path switched ring is shown in Figure 2-1(b.). In this case, the fiber failure between nodes C and D causes node C to switch from the counterclockwise ring to the clockwise ring, thus maintaining service between node A and C.

A network which requires the bulk of its traffic to be dropped at a single node is an ideal application for path switched rings. A typical loop feeder network, where most traffic is between the subscriber loop to a central office, fits this mold. Such an application calls for the delivery of protected DS1 and DS3 service to customer locations. In many cases, where the network serves only voice traffic and DS1s, a DDM-2000 OC-3/*SLC*-2000 path switched ring is a perfect fit. If DS3 service or a mixture of DS1 and DS3 service is needed, multiple OC-3 rings or an OC-12 ring may be necessary. Cost, fiber availability, and bandwidth flexibility all play a part in determining whether a single OC-3 ring, multiple OC-3 rings, or an OC-12 ring will be the best network solution.

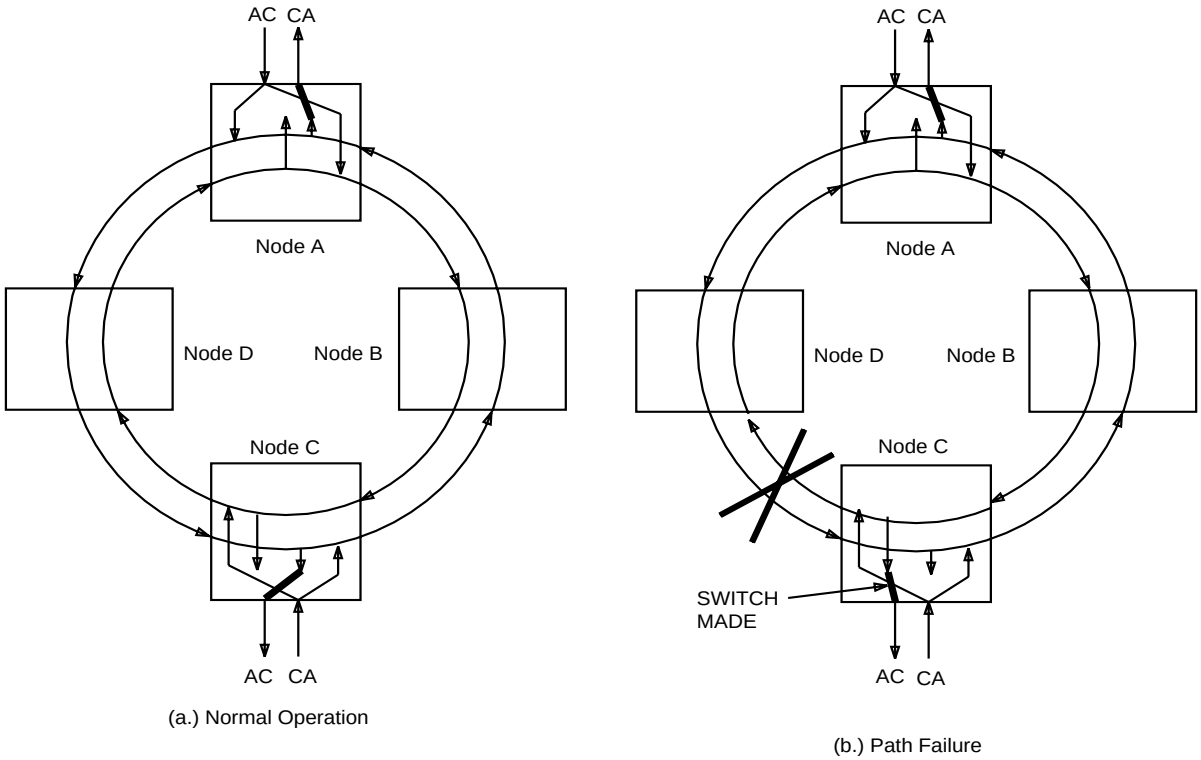


Figure 2-1. Path Switched Ring

OC-12 Path Switched Rings

The DDM-2000 OC-12 Multiplexer provides STS-1/STS-3c level path protection switched ring capability. As shown in Figure 2-2, it provides transport of 12 DS3s, 12 EC-1s, 4 OC-3cs, or a mixture with path switching at the STS-1 level (STS-3c level for OC-3c traffic). Such a ring provides an economical, flexible, and reliable solution for loop feeder networks.

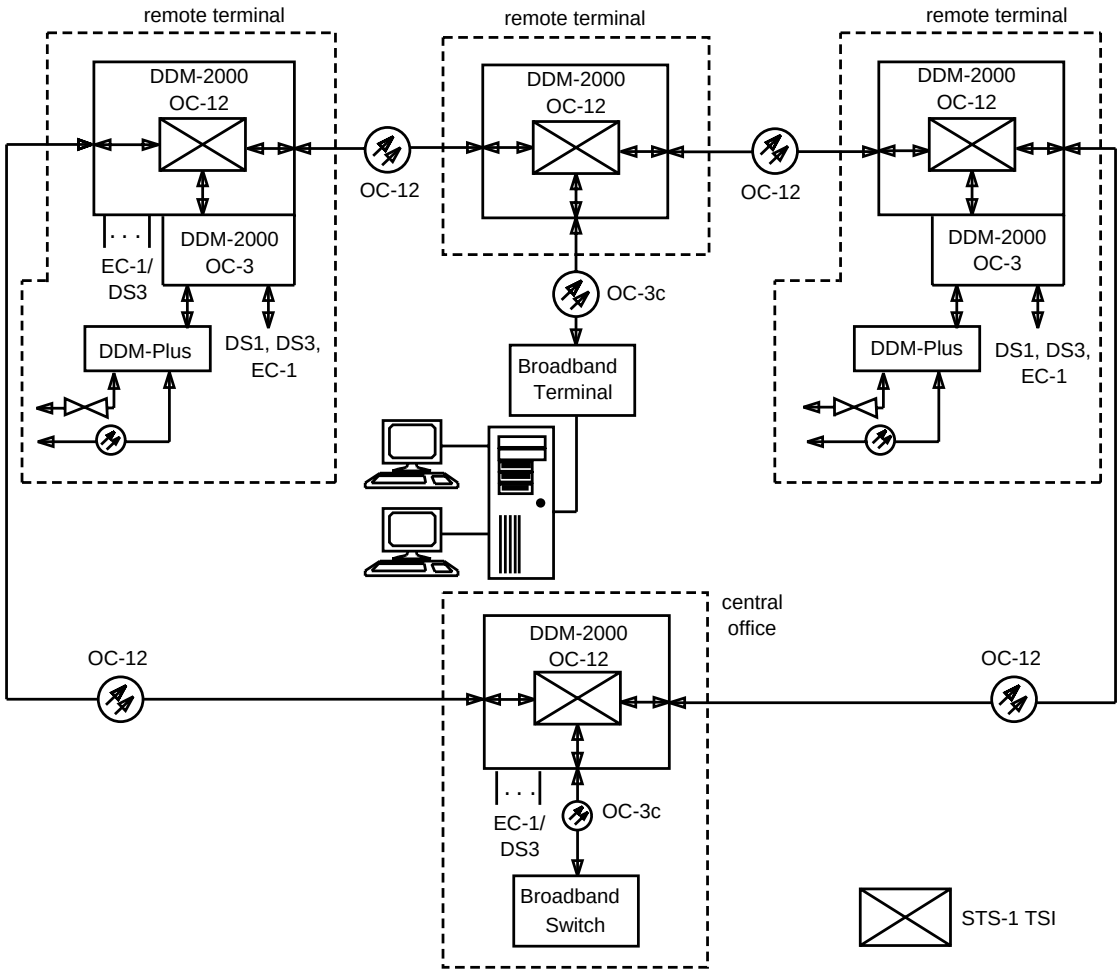


Figure 2-2. OC-12 Path Switched Ring — STS-1 Level Path Switching

Figure 2-3 shows how DDM-2000 OC-3 and OC-12 Multiplexers can be used together to provide a path switched ring operating simultaneously at the VT1.5, STS-1, and STS-3c levels. This ring is especially useful for loop feeder applications with large bandwidth needs. It can also be developed as a result of an upgrade from an OC-3 ring in an environment where growth has exhausted the bandwidth of the OC-3 ring.

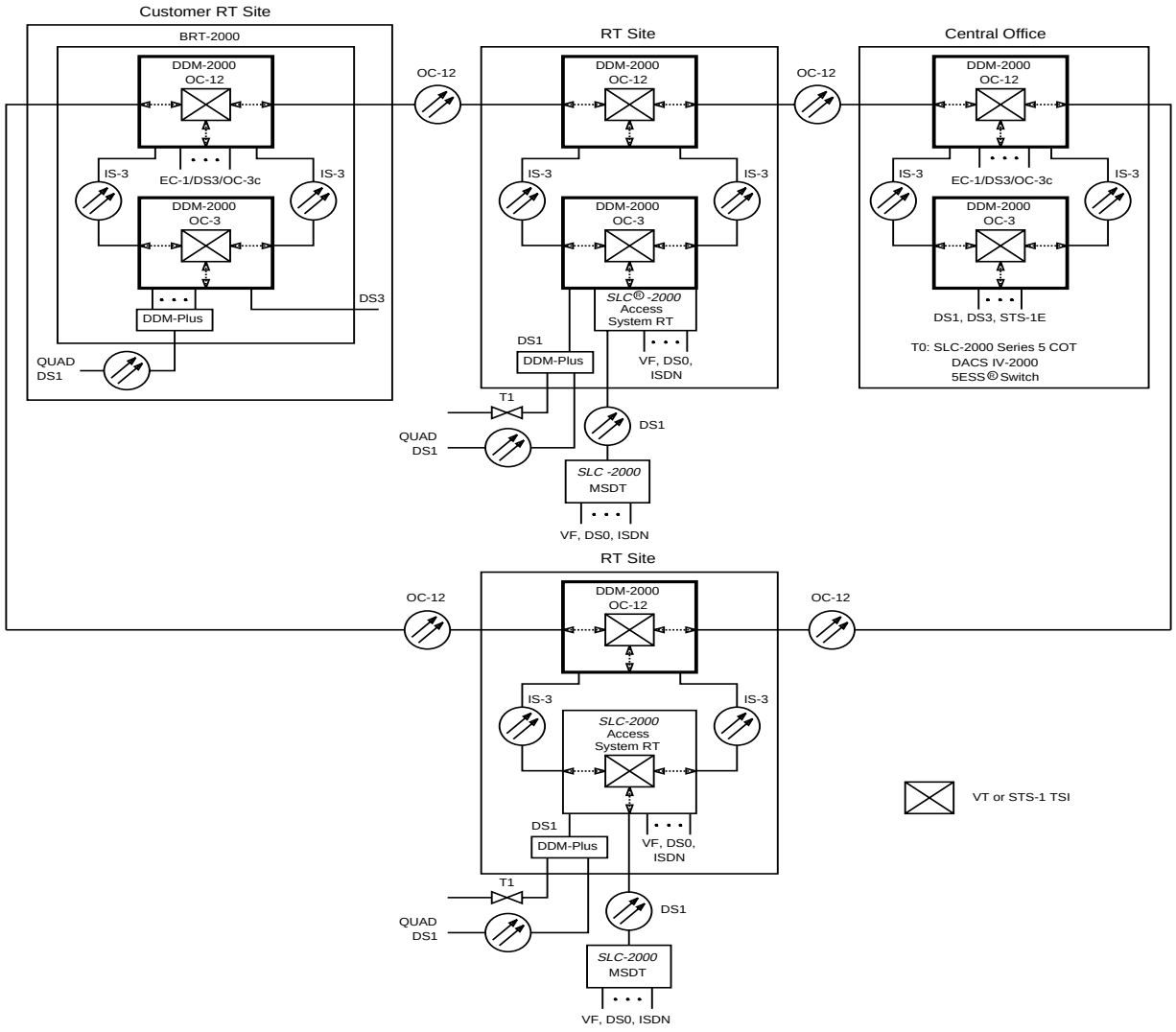


Figure 2-3. OC-12 Path Switched Ring Using OC-12 Multiplexer—Mixed STS-1 and VT1.5 Path Switching

If fiber exhaustion is a problem, the 2000 Product Family provides several alternatives for the network planners to pick from, depending on the specifics of their application. If fiber is available, multiple DDM-2000 OC-3 Multiplexer rings can be installed; or if fiber is unavailable or if the administrative ease of a single ring is desired, a single DDM-2000 OC-12 Multiplexer ring can be installed. Fiber exhaustion often occurs when customer demand for voice, DS1, and DS3 services grows to fill the OC-3 ring's capacity. If the growth has come from only one or two sites and there is spare fiber in place, these high demand sites may be cut to a new OC-3 ring without interrupting service. Alternatively, driven by fiber exhaustion or evolution to customer DS3 services, the OC-3 ring may be upgraded in service to an OC-12 ring. In this configuration (Figure 2-4), DDM-2000 OC-3 Multiplexer equipment is co-located with a DDM-2000 OC-12 Multiplexer shelf to provide a unified VT1.5 path switched ring node with an OC-12 high-speed interface.

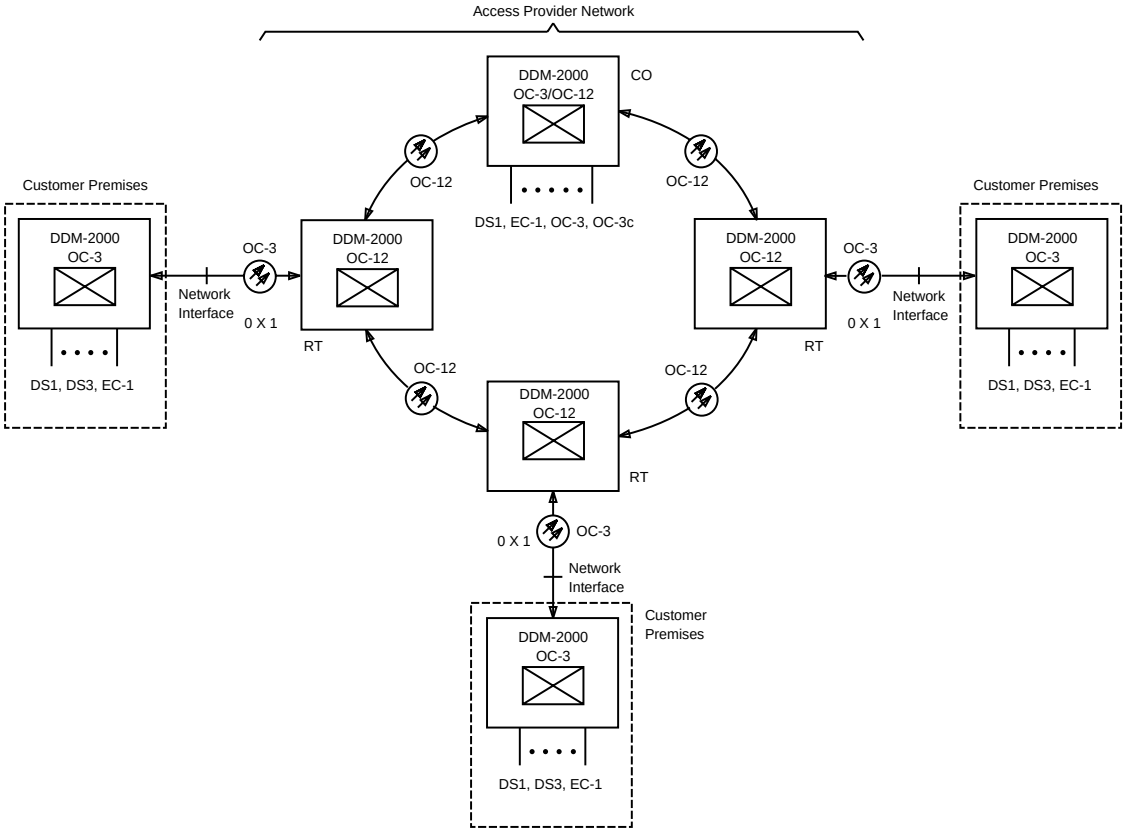


Figure 2-4. OC-3 Ring with OC-12 Ring Transport

VT1.5 bandwidth rearrangement is available which allows the unused VT1.5s from an STS-1 dropped at one site to be dropped at other sites. All DDM-2000 OC-3 and OC-12 Multiplexer shelves connected together in this subnetwork can communicate, using the single-ended operations capability of DDM-2000 Multiplexers. Once the DDM-2000 Multiplexer OC-12 ring is in place, it can be used by itself to provide STS-1 level path switching with DDM-2000 OC-3 Multiplexers to provide VT1.5 level path switching, or in a mixed configuration where both STS-1 level and VT1.5 level switching are supported simultaneously.

The link between the DDM-2000 OC-12 and OC-3 Multiplexers is 0x1 protected for this ring configuration. In this case, the DDM-2000 OC-12 Multiplexer feeds STS-1s directly off of each ring rotation to the DDM-2000 OC-3 Multiplexer where path switching is done. Switching is not done on the DDM-2000 OC-12 Multiplexer; rather VT1.5 or STS-1 level switching is done on the DDM-2000 OC-3 Multiplexer. Interconnecting the DDM-2000 OC-12 and OC-3 Multiplexers via a 0x1 interface allows the same STS-1 to be dropped to DDM-2000 OC-3 shelves at several nodes on the OC-12 ring. This combination of interconnected DDM-2000 OC-12 and OC-3 Multiplexers provides full VT1.5 switching granularity across the entire OC-12 bandwidth at any node on the ring, resulting in a full-fledged VT1.5 path switched OC-12 ring.

The DDM-2000 OC-12 path switched ring can be used in conjunction with the DDM-2000 OC-3 Multiplexer by an access provider to provide OC-3 ring service on an OC-12 ring for end users. It is becoming more frequent that a single end user desires a virtual private network from an access provider to connect several sites in a metropolitan area together. It is accomplished by deploying a DDM-2000 OC-12 ring in conjunction with DDM-2000 OC-3 Multiplexers. As described previously, the DDM-2000 OC-3 Multiplexers provide VT1.5 and STS-1 path switching; however, in this case, they are placed at end-user locations. The DDM-2000 OC-3 equipment is then used exclusively by that end user and three STS-1s worth of bandwidth are reserved on the OC-12 ring for that end user.

The end user is given log-on privileges to the OC-3 equipment located on their premises, allowing them to gather performance data, provision service, and administer their virtual OC-3 ring network. From the end user's point of view, they have a virtual OC-3 ring network at their disposal.

For customers who have significant bandwidth demands or whose geographical situation requires additional OC-3 shelves from a single OC-12 location, Figure 2-5 shows how these applications can also be met. In addition, diverse routing to two separate OC-12 shelves can increase the reliability of the network even further.

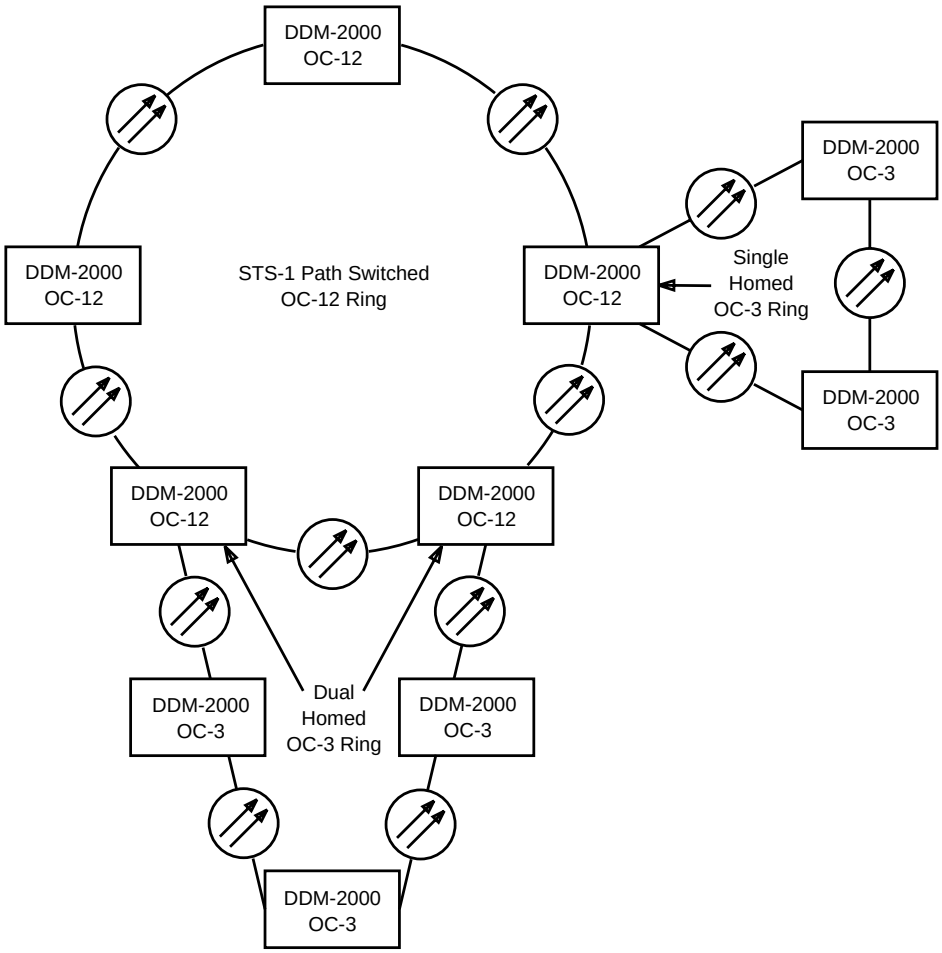


Figure 2-5. Multinode OC-3 Ring With OC-12 Ring Transport

The DDM-2000 OC-3 and OC-12 Multiplexers' path switched ring capabilities work together to provide cost-effective transport for small or medium cross-section interoffice networks such as outstate trunks. Such a ring, shown in Figure 2-6, provides DS1, DS3, EC-1, and OC-3c transport.

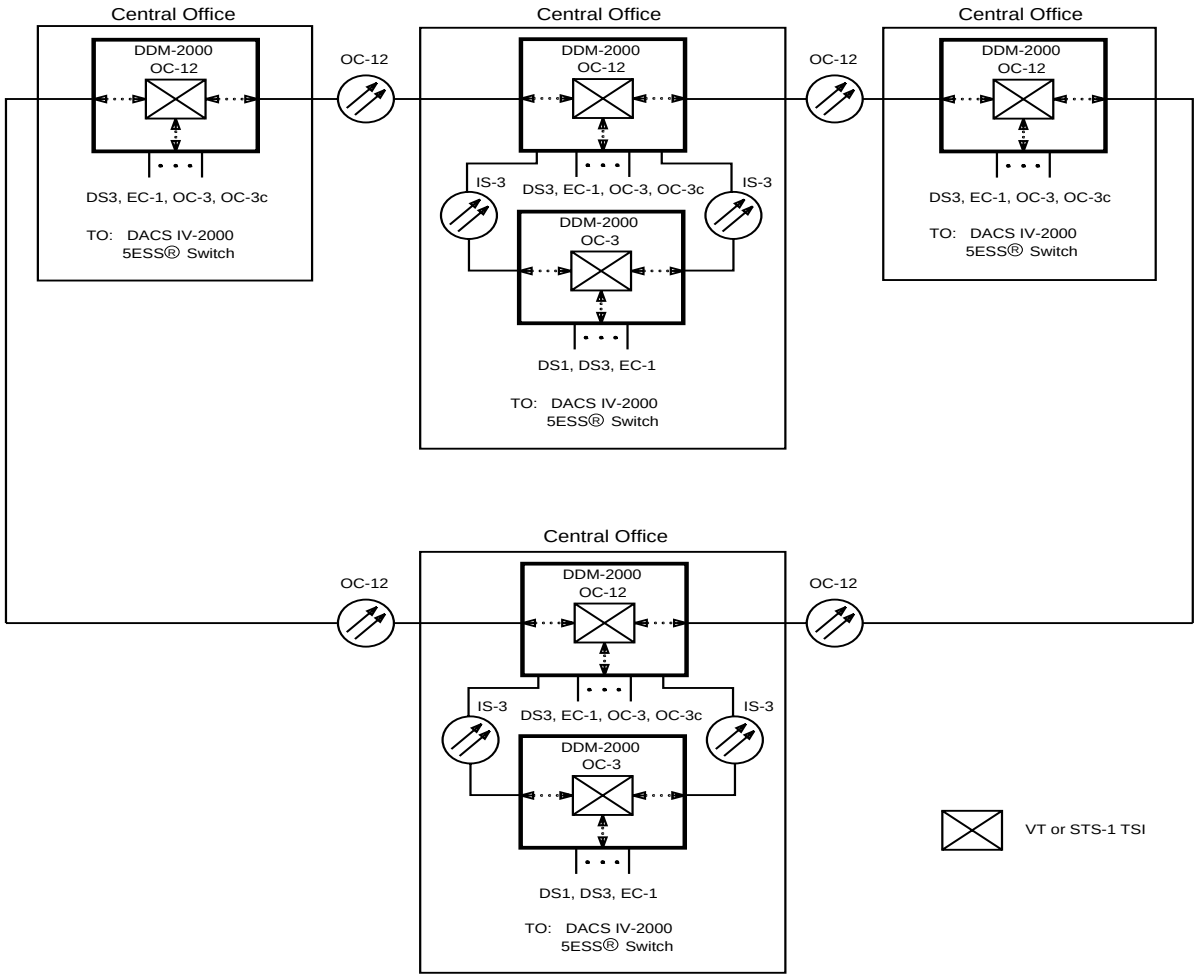


Figure 2-6. DDM-2000 OC-12 Path Switched Interoffice Ring

In a ring configuration, the DDM-2000 OC-12 Multiplexer can provide two high-speed optical interfaces. At a 1310 nm wavelength, it supports a span length of up to 51 kilometers (32 miles) without regenerators. At a 1550 nm wavelength, it supports a span length of up to 100 kilometers (61 miles) without regenerators. Regenerators or add/drop systems can be used to increase the distances for 1310 nm installations.

Each ring node can be independently synchronized from a Building Integrated Timing Supply (BITS) clock. This BITS clock can also be timed using the DDM-2000 DS1 timing output feature.

OC-12 STS-1/VT1.5 Path Switched Ring (0x1)

The DDM-2000 OC-12 ring supports (0x1) OC-3/IS-3 interfaces in its Function Unit slots. These interfaces must be provisioned as 0x1. Signals pass through the DDM-2000 OC-12 transport ring and exit to the DDM-2000 OC-3 ring. OC-12 Function Unit slot FN(x)-1 is connected to OC-3 Main-1 and OC-12 Function Unit slot FN(x)-2 is connected to OC-3 Main-2. Switching is not done on the DDM-2000 OC-12 Multiplexer on these lines, or paths on these lines; rather VT1.5 or STS-1 level path switching is done on the DDM-2000 OC-3 Multiplexer. This allows DDM-2000 OC-3 nodes running ring software to interface with DDM-2000 nodes of an OC-12 ring in such a way as to provide ring-on-ring architecture. Each OC-3 ring so supported occupies up to three STS-1 time slots on the OC-12 ring. Each OC-12 node can provision the same STS-1 time slots as other OC-12 nodes to drop to the OC-3 shelf (to share STS-1s among several OC-3 shelves) or the OC-12 node can provision different STS-1s at different sites. With 0x1 operation, the OC-12 ring passes the contents of these STS-1 time slots between the low-speed OC-3/IS-3 lines and OC-12 high-speed lines without terminating them or performing any path protection switching on them. Up to four OC-3 rings can be supported in this fashion by an OC-12 ring to maximize the OC-12 bandwidth utilization. This allows access to any and all VT1.5 signals at an OC-12 site. Since the high-speed signals from the OC-3 ring(s) are sent as two copies (one clockwise, the other counter-clockwise) on the OC-12 ring, the OC-12 ring capacity is limited to the OC-12 line rate.

The OC-3/IS-3 lines between an OC-12 node and an OC-3 node connected in a ring (0x1) fashion, behave like the OC-3 lines between the nodes on an OC-3 ring and do not perform line level protection switching. Instead, the OC-3 shelves perform the normal path protection switching functions.

Folded Ring

DDM-2000 OC-3 and OC-12 rings offer several benefits in addition to service assurance. Economically, a ring network minimizes overall network cost by requiring fewer optical transmit/receive units than a comparable linear add/drop network. Operationally, a ring network provides significant flexibility to increase bandwidth at existing nodes and to add new nodes at locations where unanticipated bandwidth is required.

These benefits make rings highly desirable even when fiber route diversity is not available. When route diversity is not available on part or all of the ring, ring technology can be used to support split and tapered feeder routes to derive economic benefits, provide bandwidth flexibility, ease the process of adding and deleting nodes and supply survivability against single-node failures.

When route diversity is not available or fiber cable cuts are not a driving concern, the two-fiber path switched ring feature can be applied in a "folded" (a folded ring is a single path ring) configuration (Figure 2-7). This use of DDM-2000 OC-3, OC-12, and *SLC*-2000 access resource manager (ARM) path switched rings applies in particular to hubbing and linear topologies where there is no return path from the end remote site to the central office (CO). While a complete cut through the fiber cable cannot be protected, single-node equipment failures are still protected. Furthermore, a two-fiber ring ARM uses only one optical transmitter/ receiver in each direction (two per remote shelf), in contrast to a 1+1 line protection arrangement that requires four optical transmitter/receivers per remote shelf. Thus the ring configuration reduces equipment costs, a benefit independent of its survivability advantage. The ring topology also makes node addition/deletion straightforward.

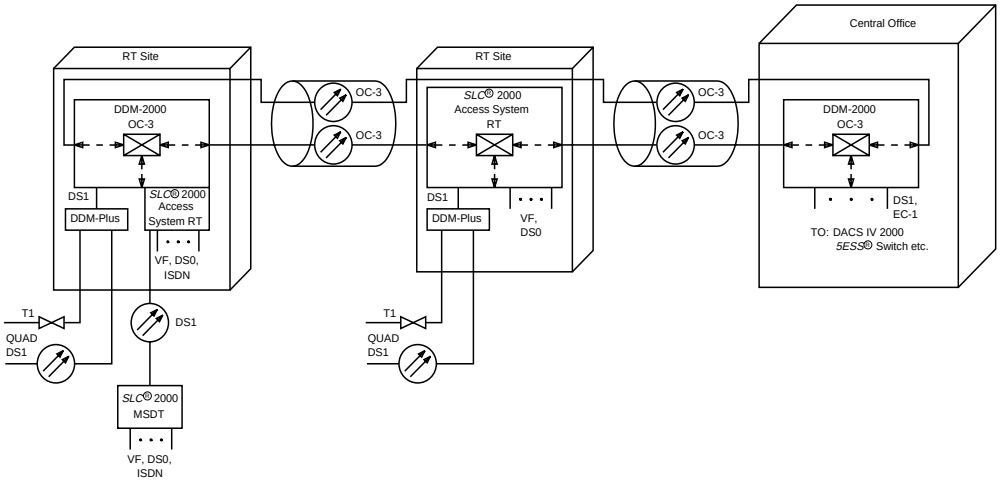


Figure 2-7. Folded Ring Configuration

OC-3 Ring Transport on OC-12 Point-to-Point

Rings that cover a large geographical area or interconnected path switched rings are a cost effective and popular way for a service provider to offer these high priority services. Figure 2-8 shows a ring configuration using DDM-2000 OC-3 ring nodes with DDM-2000 OC-12 point-to-point nodes to provide a high-service availability architecture. This configuration will survive fiber, equipment, and catastrophic office failure, since it provides an alternative service path through a secondary CO and uses the path switching ability of the DDM-2000 OC-3 to select between these two paths. In this example, the OC-12 NEs are connected as folded rings in a point-to-point configuration; 0x1 cross-connects are used to connect with the OC-3 rings.

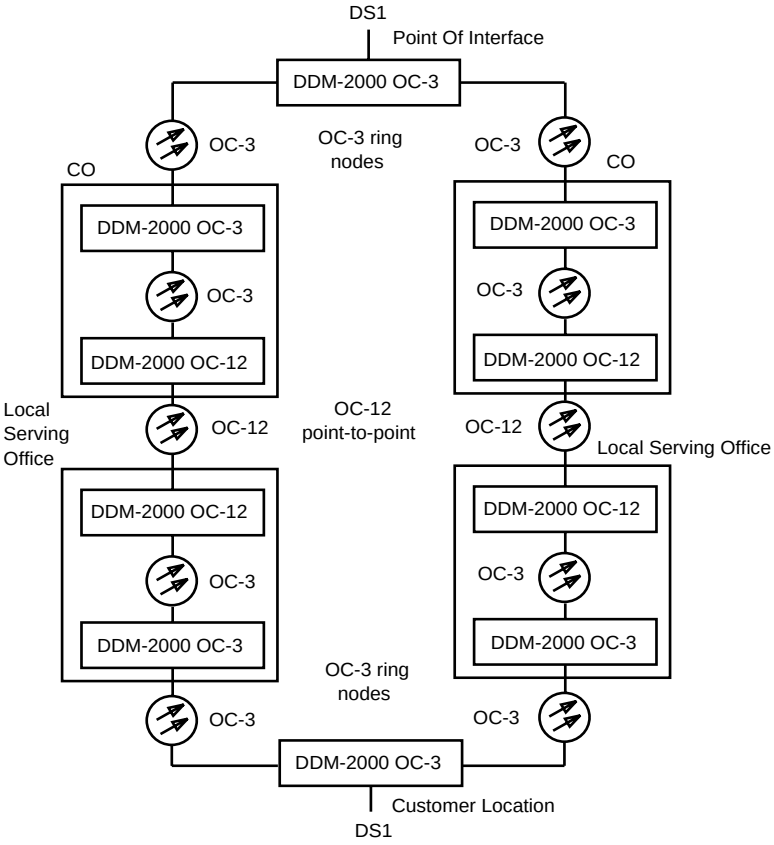


Figure 2-8. OC-3 Ring Transport on OC-12 Point-to-Point

Dual Homing

End-users are demanding service with higher and higher availability. Service providers are responding with tariffs that rely on self-healing networks to offer such high availability service. Some of these tariffs even call for penalties for the service provider when service is interrupted or has a high error rate. The Lucent SONET product family offers many options for meeting these service needs.

OC-1 Ring transport on OC-3 Ring and OC-3 Ring transport on OC-12 ring networks can be implemented in dual homing configurations.

Dual Ring Interworking (DRI)

In an interconnected ring or DRI topology, two rings are connected together at two geographically separate nodes. In addition to the facility and node failure protection that a single ring provides, the dual node interconnection between the rings provides an automatic alternate route in the event of a catastrophic failure at one of the interconnecting nodes. Typically, such a topology is used to interconnect a loop feeder access ring to a higher bandwidth interoffice ring as shown in Figure 2-9. This architecture can withstand any single equipment or fiber failure in each of the rings or a failure (which could range from a CO shutdown in the case of fire, for example, or equipment failure, or failure of the facility connecting the two rings) of either of the two interconnecting nodes without losing service on either the access ring or the interoffice ring. Such a catastrophic failure would cause a service outage for a simple ring architecture.

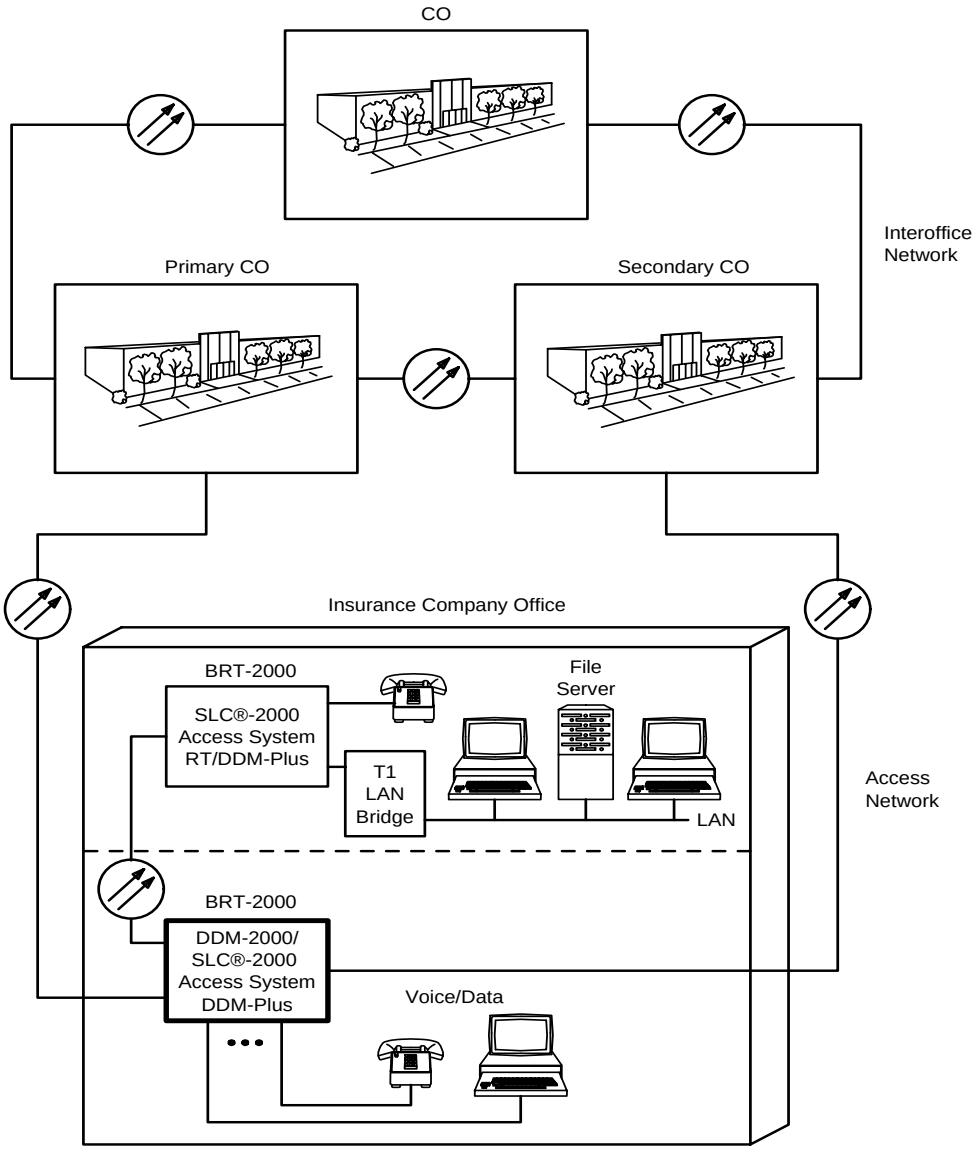


Figure 2-9. Dual Access Configuration

As Figure 2-10 shows, DRI allows a circuit (for instance, between nodes A and Z) with one termination in the upper ring and the other termination in the lower ring to survive a failure of the shared node that is currently carrying service for the circuit. The failure is depicted by an "X" in the figure. The two shared nodes are in CO B and CO C. Both nodes have the signal available to them at all times. When a failure occurs, the two terminating nodes and the two shared nodes switch so that traffic is carried through CO C and around the node failure.

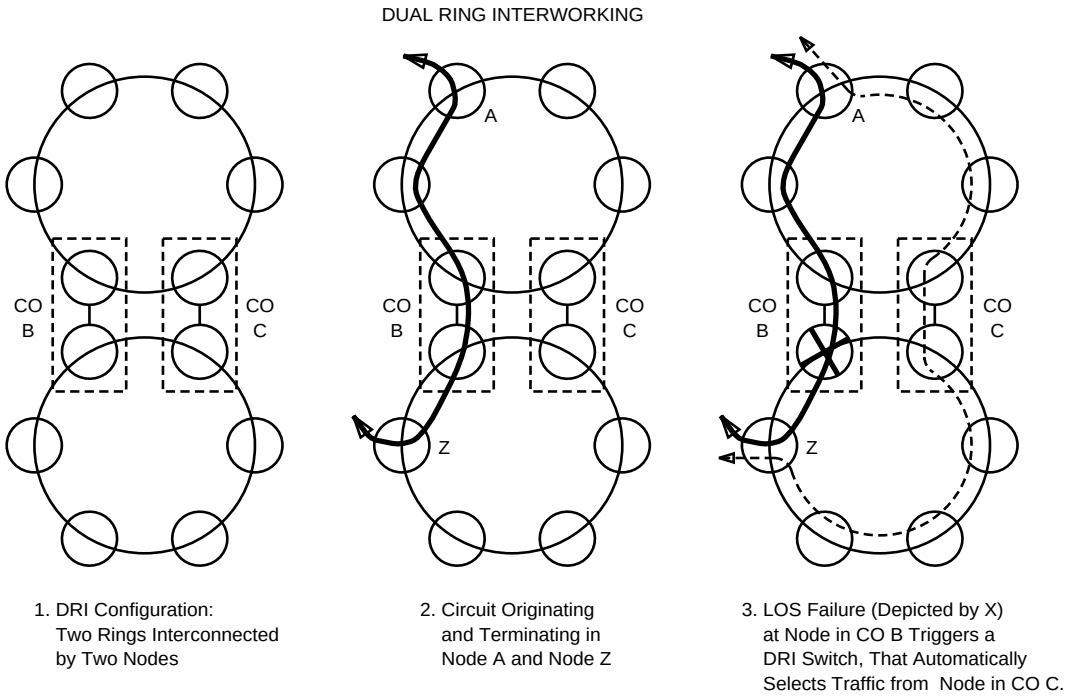


Figure 2-10. Dual Ring Interworking Concepts

DDM-2000 OC-3, OC-12, and FT-2000 OC-48 Lightwave Systems can be configured to offer this topology. Often the DDM-2000 equipment is used for the loop feeder access ring, and the FT-2000 OC-48 Lightwave System equipment is used for the interoffice ring. Figure 2-11 shows a DDM-2000 OC-3 (or OC-12) path switched ring interworking with an FT-2000 OC-48 Lightwave System bidirectional line-switched ring.

In this application, the DDM-2000 provides an appearance of loop traffic at both the primary and secondary nodes by dropping traffic at the primary node and simultaneously continuing it on to the secondary node. This capability is called "drop-and-continue." The DDM-2000 OC-3 Multiplexer allows DS1 signals to be multiplexed for handoff at an economical EC-1 or OC-3 rate in the COs. Also, the DDM-2000 OC-3's flexible TSI can be used to prepackage all DRI protected DS1s into a single EC-1 for economical handoff to the OC-48 ring. This capability allows for the easy mixing of DRI and non-DRI services on the same ring network. In this way, only specially tariffed services need to be configured for the extra reliability that DRI provides. DS3/STS1 clear channel services are also supported. The companion FT-2000 OC-48 Lightwave System ring picks up the traffic at these two nodes and carries it to the destination node, unless a failure condition causes a protection switch to the secondary signal. In the reverse direction, a similar process is followed with the OC-48 ring handing off the two copies of the signal at the primary and secondary nodes and the OC-3 ring providing the switching at the destination node.

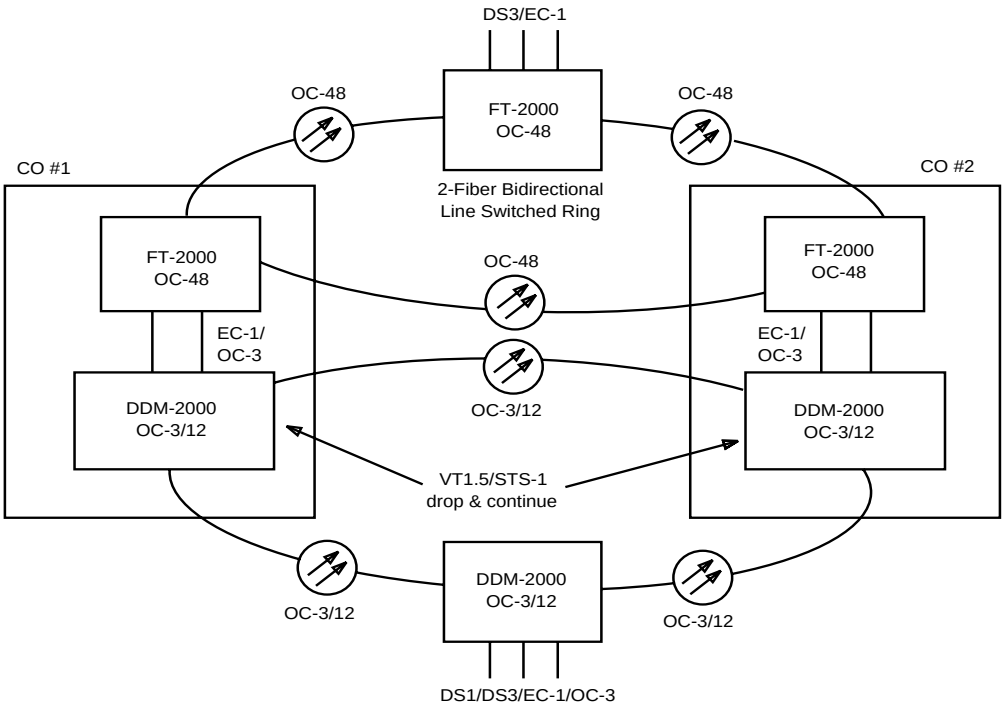


Figure 2-11. OC-3/12 to FT-2000 OC-48 Lightwave System Dual Ring Interworking

The DDM-2000 drop-and-continue feature also finds an excellent application in interconnecting two rings via an intermediate transport network. In the example shown in Figure 2-12, DDM-2000 OC-3 Multiplexer access rings act as a DRI pair via an FT-2000 OC-48 Lightwave System and DACS IV-2000 interoffice network. The advantage of this network is the grooming for DRI traffic provided by the DACS IV-2000. Both DDM-2000 OC-3 rings provide drop and continue at each of their two duplicate COs. Both copies of the signal are transported as separate tributaries through the interoffice network, and path switching is implemented at the edges of the network. Signal redundancy is preserved on an end-to-end basis.

In offices where SONET interconnections are not available, DS3 interfaces can be used between dual OC-12 offices. The DDM-2000 OC-12 Multiplexer also supports DS3 DRI in addition to the EC-1 and OC-3 interfaces. In the event of an incoming DS3 failure from the DSX-3, the OC-12 Multiplexer inserts an STS-1 AIS signal into the STS-1 ring channel used by the DS3 to activate the downstream STS path protection switch. It is recommended that SONET DRI interfaces (EC-1 or OC-3) be used if possible since the DS3 to STS-1 AIS translation feature is on the OC-12 Multiplexers only (R5.1 and later).

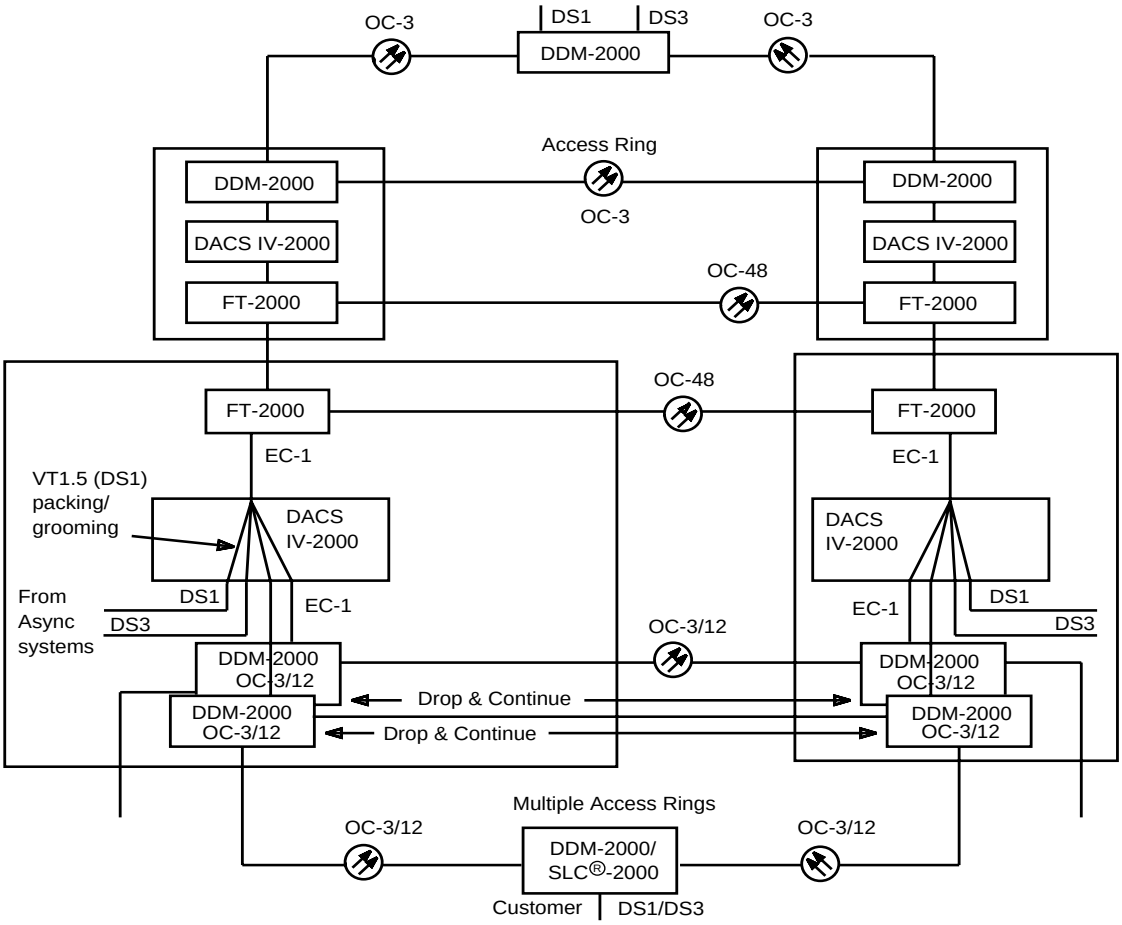


Figure 2-12. DDM-2000 Ring Interworking with FT-2000 OC-48 Lightwave System Transport and DACS IV-2000 Grooming

OC-3 Linear Optical Extensions from OC-3 and OC-12 Rings

An additional topological flexibility offered by the DDM-2000 OC-3 and OC-12 Multiplexers is 1+1 protected linear OC-3 and IS-3 optical extensions from OC-3 and OC-12 rings. Using this capability, the DDM-2000 OC-3 and OC-12 Multiplexers can support many of the new network configurations desired in the evolving loop feeder environment. As Figure 2-13 shows, an access provider can use linear optical extensions from an OC-12 ring to provide OC-3/OC-3c signals directly to end users. This gives the end users the bandwidth they need for large bandwidth applications, such as video, and provides it to them via the path switched ring architecture they require for high service availability. If enabled, full single-ended operations are available on all network elements (NEs). This gives the end user full control of performance monitoring (PM) data, network reconfigurations, and provisioning of the network.

OC-3 optical extensions can also be used to interconnect SONET subnetworks. Examples include interconnection of two access networks and interconnection between access and interoffice rings. Optical extensions can be used to interconnect OC-3 and OC-12 ring subnetworks to an OC-3 terminal, OC-3 and OC-12 add/drop networks, and another OC-3 or OC-12 ring.

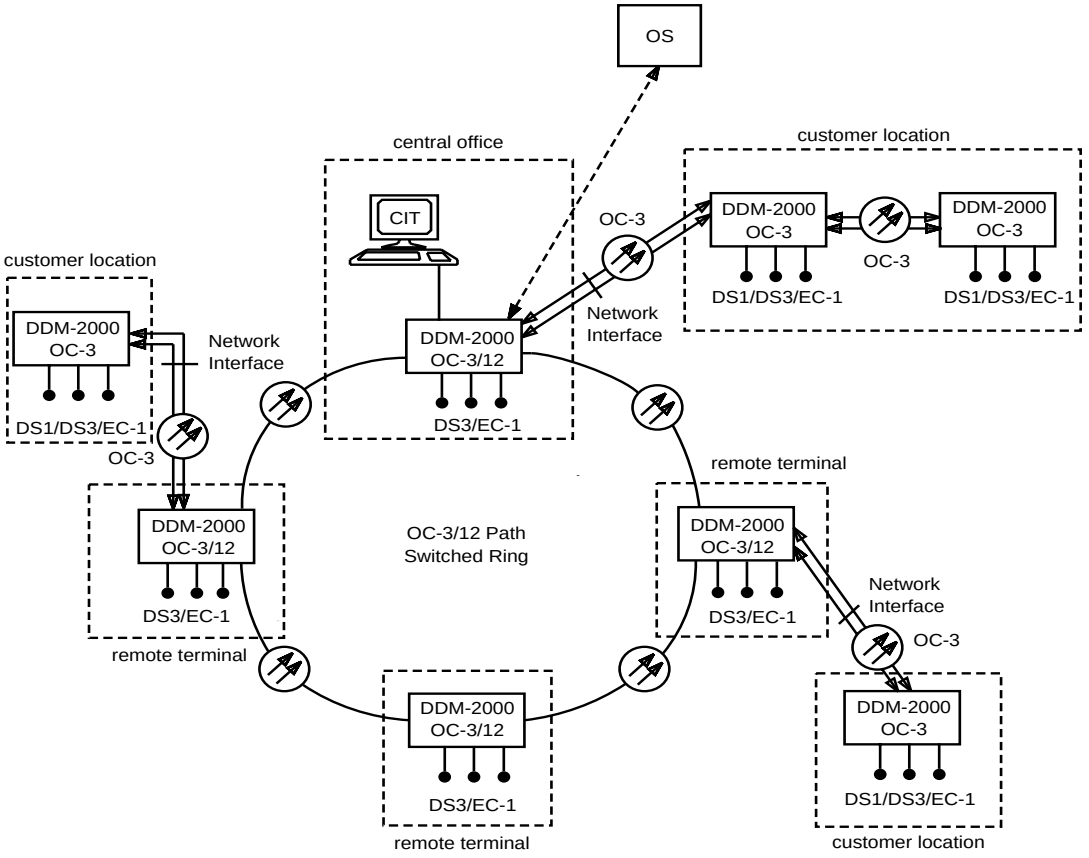


Figure 2-13. OC-3 Services Using Linear Optical Extensions

OC-12 Point-to-Point (Folded Ring)

Simple, efficient capacity upgrades provide an additional point of flexibility for the DDM-2000 OC-3 and OC-12 Multiplexers. Initial deployments can be sized according to current needs and near-term forecasts, which minimize the network's cost. As large-scale growth occurs (for example, DS1 and DS3 service expansion), the DDM-2000 OC-3 and OC-12 Multiplexers can be rearranged to match each application.

The upgrade from a DDM-2000 OC-3 point-to-point system to a DDM-2000 OC-12 system can be done without interrupting service. The procedure converts the DDM-2000 OC-3 Multiplexer shelves so that they interconnect with the DDM-2000 OC-12 Multiplexer shelf. The resulting high-capacity, point-to-point configuration is shown in Figure 2-14. The larger bandwidth accommodates additional DDM-2000 OC-3 Multiplexers for DS1 access.

In addition to upgrading an existing OC-3 network, the DDM-2000 OC-12 Multiplexer also provides DS3, EC-1, OC-3 or OC-3c service transport between a remote site and a CO. It can do this in either a stand-alone (terminal) configuration or, if desired, it could be connected directly to a DACS IV-2000 Cross-Connect System using DS3 or EC-1 interfaces.

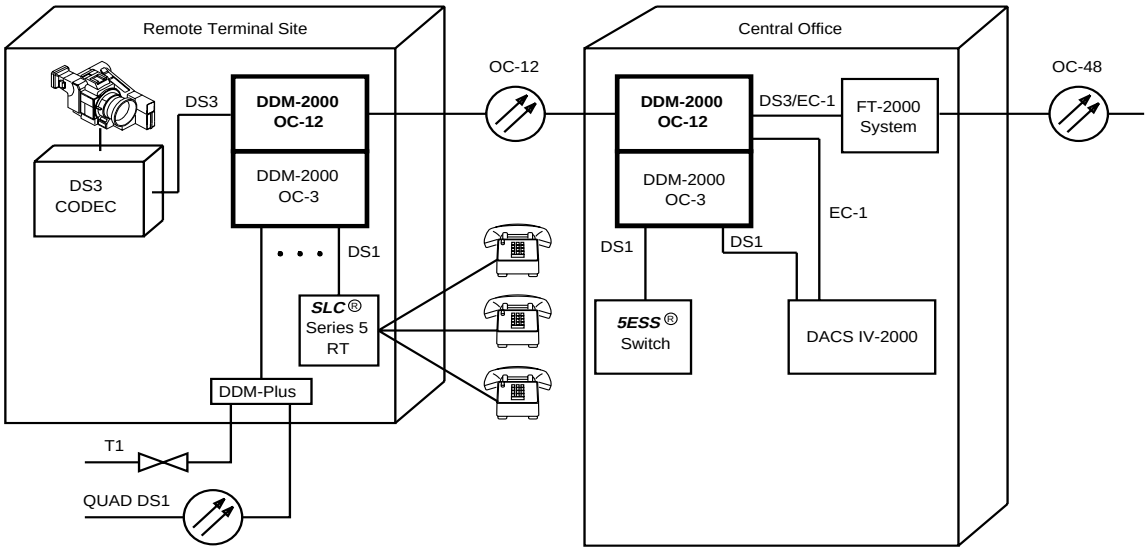


Figure 2-14. OC-12 Point-to-Point Loop Configuration (Folded Ring)

Like the loop feeder point-to-point applications, the interoffice DDM-2000 OC-3 point-to-point Multiplexer application supports smooth in-service capacity upgrades using the DDM-2000 OC-12 Multiplexer (Figure 2-15). The initial DDM-2000 OC-3 Multiplexer shelf is connected in service to the DDM-2000 OC-12 Multiplexer, allowing high-speed interconnection between offices. The DDM-2000 OC-12 Multiplexer is also well suited for stand-alone interoffice transport of high-capacity DS3, EC-1, and OC-3c signals. The DDM-2000 OC-12 Multiplexer offers two high-speed optical interfaces: at a wavelength of 1310 nm, it supports a 51 kilometer (32 miles) span length; and at a wavelength of 1550 nm, it supports a 100 kilometer (61 miles) span length.

Like the DDM-2000 OC-3 Multiplexers, the DDM-2000 OC-12 Multiplexers allow independent synchronization of each site from its own office clock and disabling single-ended operations when the application crosses a maintenance boundary. Timing can be passed from one office clock to another with a DS1 timing output derived from an incoming OC-12 signal.

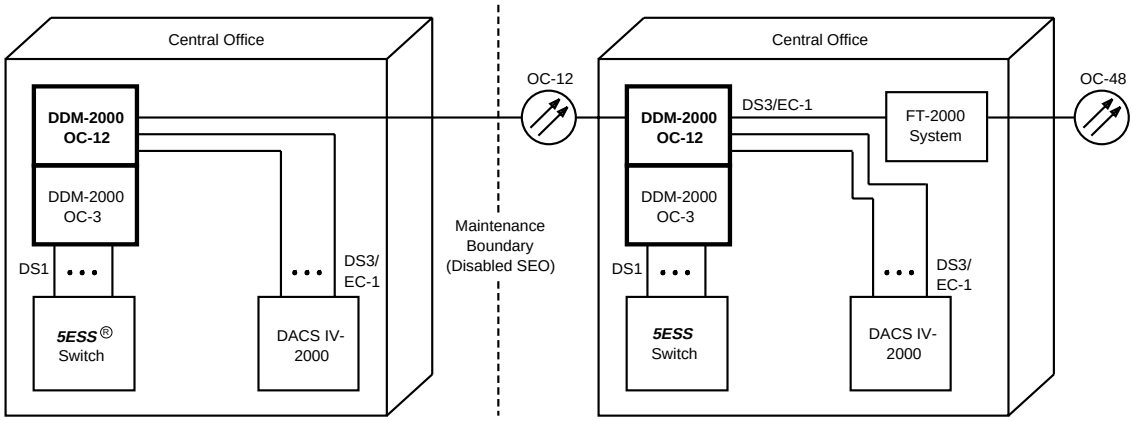


Figure 2-15. OC-12 Point-to-Point Interoffice Configuration (Folded Ring)

2000 Product Family Interworking

SLC-2000 Access System

The *SLC*-2000 Access System is Lucent's next generation digital loop carrier (DLC) system. The *SLC*-2000 Access System can be installed in any existing pair gain application, providing telephone service, ISDN capability, DS1 pipes, and special services. Full DS0 bandwidth management capabilities (based on Bellcore TR-303) provide for more efficient and flexible network growth.

Figure 2-16 shows a business narrowband application using the DDM-2000 FiberReach Multiplexer on an OC-1 path switched ring. This application provides protected POTS, ISDN, and special services, as well as DS1 services. The ring host is a DDM-2000 OC-3/OC-12 remote node on an OC-3/OC-12 path switched ring via a *SLC*-2000 ARM or a DDM-2000 OC-3 Multiplexer. OC-1 extensions from OC-12 rings are planned in a future release.

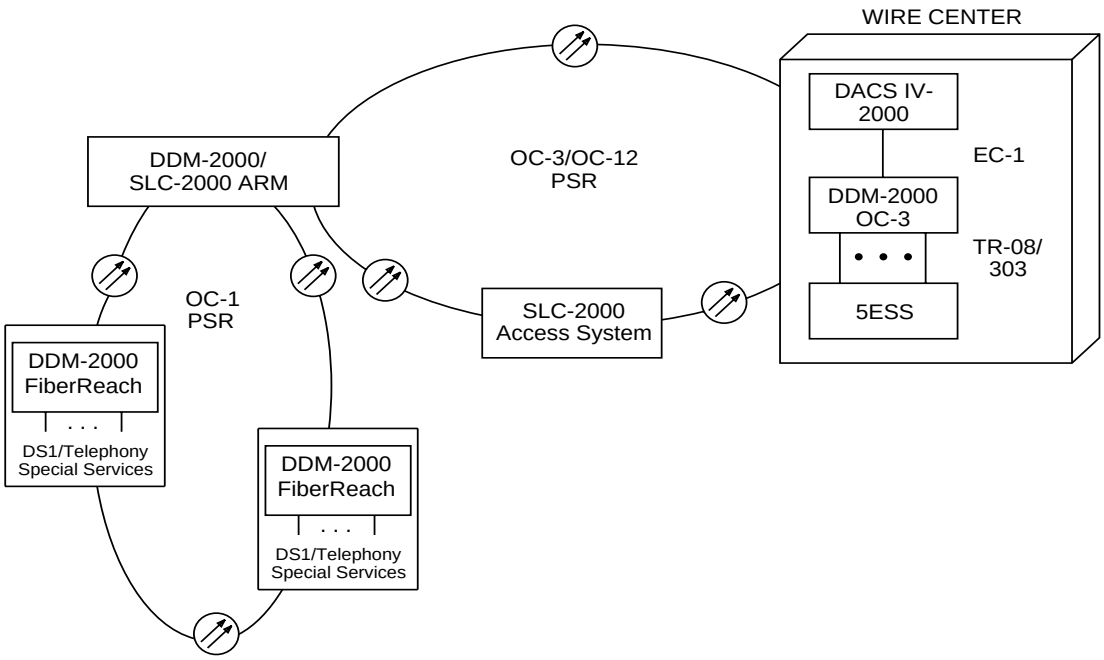


Figure 2-16. OC-3 Loop Carrier Interface Configuration

FT-2000 OC-48 Lightwave System

Operations interworking (OI) provides the capability to access, operate, provision, and administer remote Lucent SONET NEs from any location in a SONET subnetwork or from a centralized OS. Figure 2-17 shows an example of OI applications of an OC-12 ring interface between FT-2000 OC-48 Lightwave System and OC-12 ring systems. Refer to 824-102-144, *Lucent Technologies 2000 Product Family Multi-Vendor Operations Interworking Guid*e, for more information.

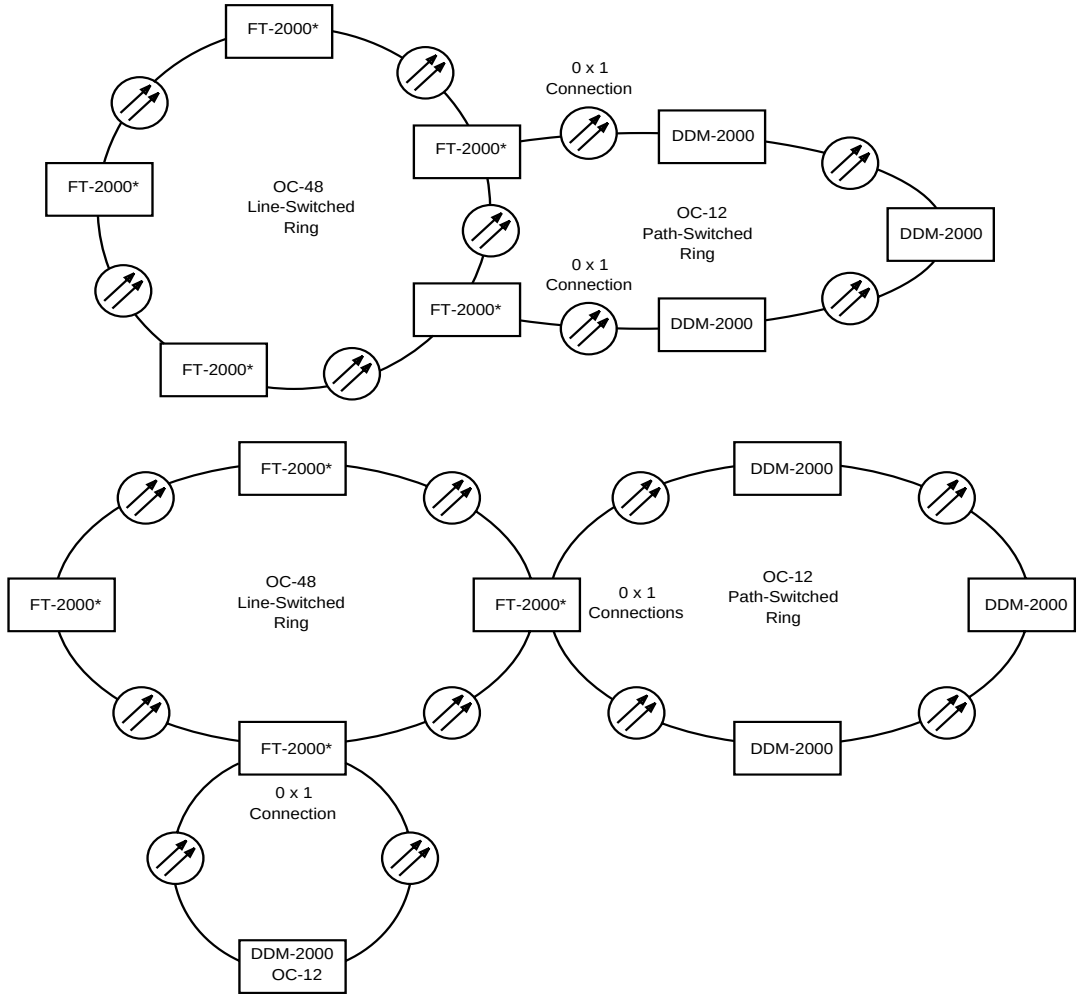


Figure 2-17. OC-12 Ring Interfaces with FT-2000 OC-48 Lightwave System

Multi-Vendor OI Applications

Figure 2-18 shows a multi-vendor application partnering Lucent's DDM-2000, FT-2000, and ITM SNC with Tellabs *TITAN** *5500* DCS. This OI, based on SONET standards, allows service providers to offer more flexible services to generate revenues and improve overall network maintenance efficiency.

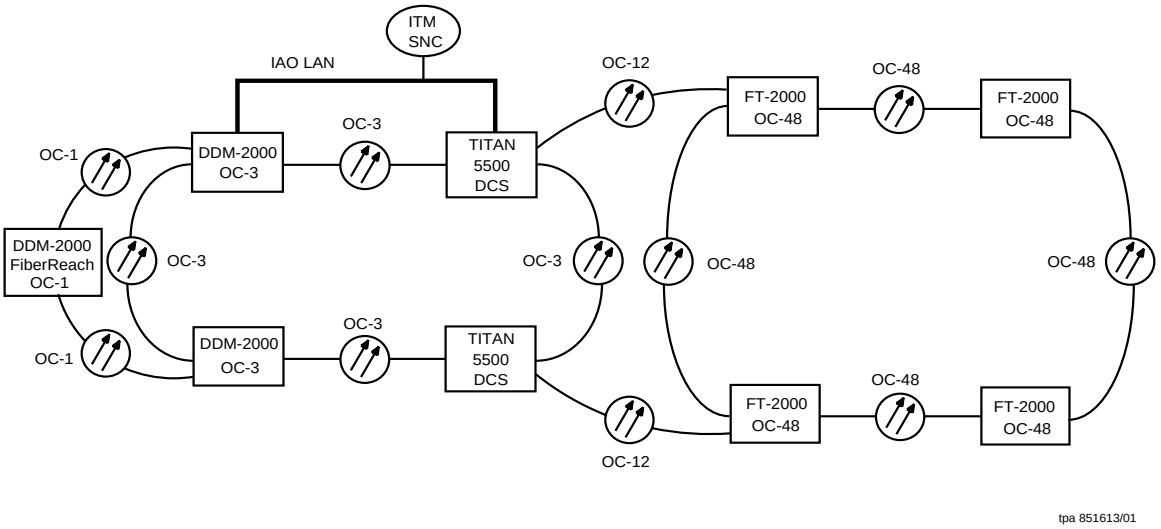


Figure 2-18. Interworking of OC-1/OC-3/OC-12/OC-48 with Tellabs ***TITAN 5500*** DCS

* *TITAN* is a trademark of Tellabs, Inc.

Service Applications

Loop Feeder

The DDM-2000 Multiplexers provide a full set of interfaces, topologies, operations and upgradability to provide the flexibility and ease of operation required to meet the dynamic requirements of the loop feeder environment.

The DDM-2000 Multiplexers are particularly suited to the evolving needs of loop feeder applications. They offer many essential features: compact size, environmental hardening, single-ended operations, and capacity and topology upgrades. The DDM-2000 Multiplexers' extensive set of topologies allows the network to be optimized for a particular route geography, service mix, and growth forecast.

Interoffice Transport

The DDM-2000 Multiplexers provide the features necessary for interoffice transport applications. Examples include long span optics, OC-12 regenerators, easy capacity upgrades, and full DS1 and DS3 add/drop capability. Interoffice applications include point-to-point, stand-alone SONET electrical multiplexing, add/drop, path switched ring, and DRI.

The DDM-2000 OC-3 and OC-12 Multiplexers provide the following features for interoffice applications:

- DS1 transport
- DS3 transport
- EC-1 transport
- OC-3c transport
- Synchronization distribution
- Single-ended or independent operations
- Single-mode fiber spans up to 55 kilometers (34 miles) for OC-3, up to 51 kilometers (32 miles) for OC-12 at a wavelength of 1310 nm, and up to 100 kilometers (61 miles) for OC-12 at a wavelength of 1550 nm.

A VT1.5/STS-1 path switched OC-3 ring is a very effective self-healing network configuration for small cross-section interoffice networks, such as outstate trunks.

Any number of nodes in a DDM-2000 interoffice network can be independently synchronized from a BITS clock. Timing inputs can also be provided to the BITS from a DDM-2000 OC-3 or OC-12 Multiplexer using the DS1 timing output feature.

Broadband Business Access

New telecommunications needs for customer networks include higher bandwidth services based on DS1, DS3, and STS-3c rates; a self-healing capability for businesses most sensitive to service disruption; and rapid service deployment and rearrangement to keep pace with a changing environment. The flexible, advanced capabilities of the DDM-2000 OC-3 and OC-12 Multiplexers create a powerful platform along with other Lucent 2000 Product Family systems to keep pace with these dynamic customer needs.

The more a business relies on telecommunications, the more important self-healing networks become. In particular, finance, medical, transportation, education, and government users are insisting on a highly reliable network. These users are also driving for higher bandwidth data and video services.

The large multi-site medical facility shown in Figure 2-19 uses broadband services for inter-site imaging and video needs as well as lower bandwidth voice and data services into the public network based in ISDN primary rate interface (PRI) and basic rate interface (BRI) interfaces. These services can be delivered efficiently with the DDM-2000 OC-3, OC-12, and *SLC*-2000 Access System's flexible TSI and add/drop capabilities. The ring architecture prevents service outage due to a cable cut or node failure.

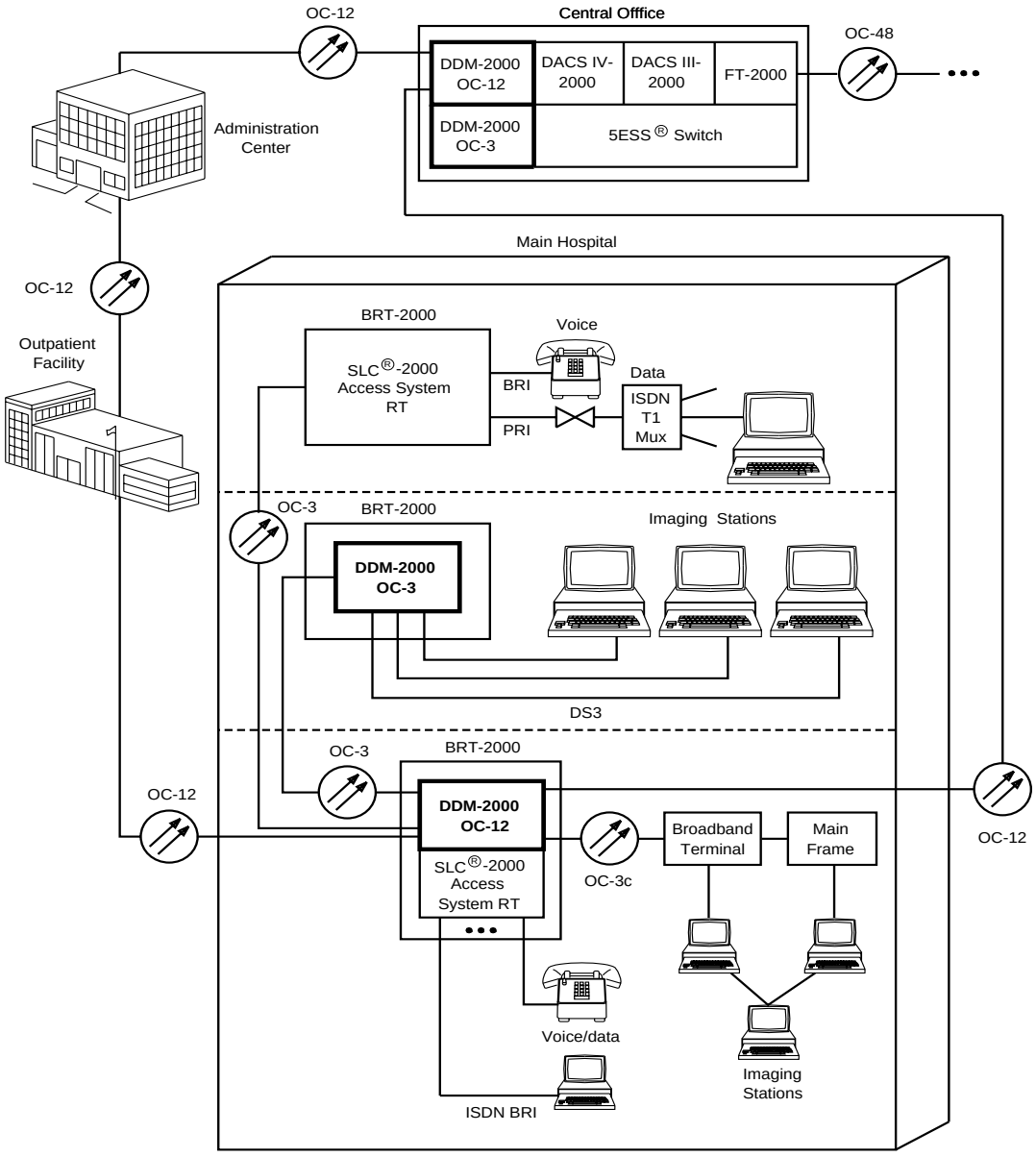


Figure 2-19. Self-Healing Medical Campus Network Application

STS-3c Video Broadcast Application

Video applications are becoming increasingly more important in the competitive home entertainment industry. The DDM-2000 OC-12 Multiplexer can be the backbone for video distribution needs as it supports two STS-3c video cross-connection types:

- COV - Video cross-connections at central offices
- RTV - Video cross-connections at remote terminals

Figure 2-20 shows the video broadcast application for the DDM-2000 OC-12 Multiplexer. In this application, incoming STS-3c signals at a "head-end" (cross-connection type **COV**) OC-12 shelf are simultaneously dropped at any number of remote OC-12 terminals (cross-connection type **RTV**). This provides the capability of simultaneously transmitting up to eight STS-3c video feeds (using both slots of fn-A/B/C and D, when equipped with OC-3 or IS-3 interfaces) to remote sites.

Significant features of this application are:

- Both inner and outer rings (mb1 and mb2) distribute up to four STS-3c unprotected one-way signals. These signals are then connected to OC-3 or IS-3 circuit packs.
- The STS-3c signals can be provisioned in pairs (two, four, six, or eight) and unused time slots can be used for other ring applications.

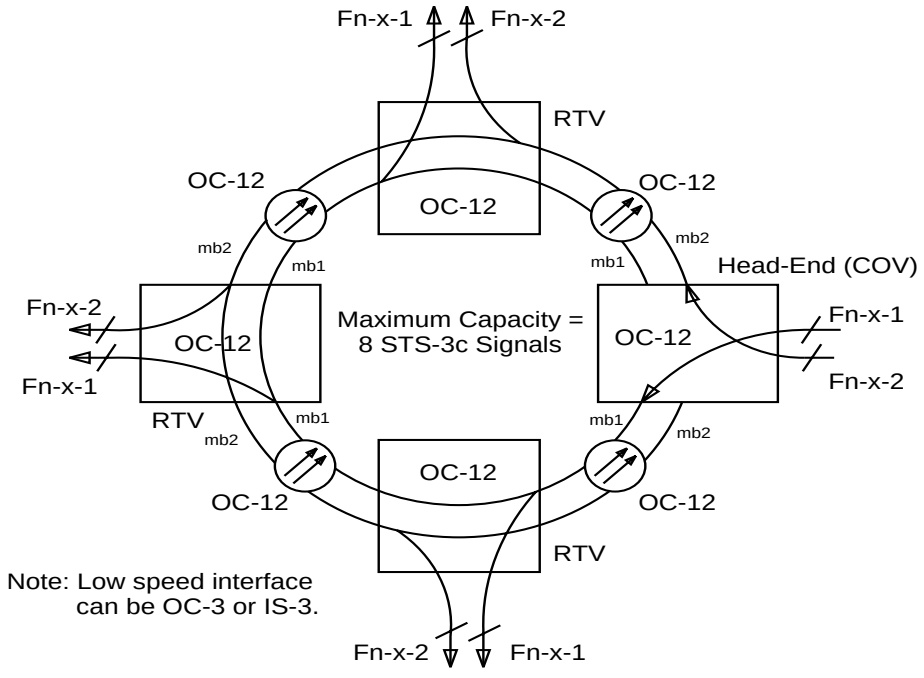


Figure 2-20. STS-3c Video Broadcast Application

STS-3c Video Application ATM Interface

Figure 2-21 shows the video application for the DDM-2000 OC-12 ring used to transport STS-3c signals from one ATM switch to another. In this scenario, each OC-12 shelf is cross-connected and provisioned as **COV** type. This provides the capability of transmitting a point-to-point STS-3c video signal from one shelf to another. Significant features of this application* are:

- Both inner and outer rings (mb1 and mb2) distribute up to four STS-3c unprotected one-way signals. These signals are then connected to OC-3 or IS-3 circuit packs.
- The STS-3c signals can be provisioned in pairs (two, four, six, or eight) and unused time slots can be used for other ring applications.

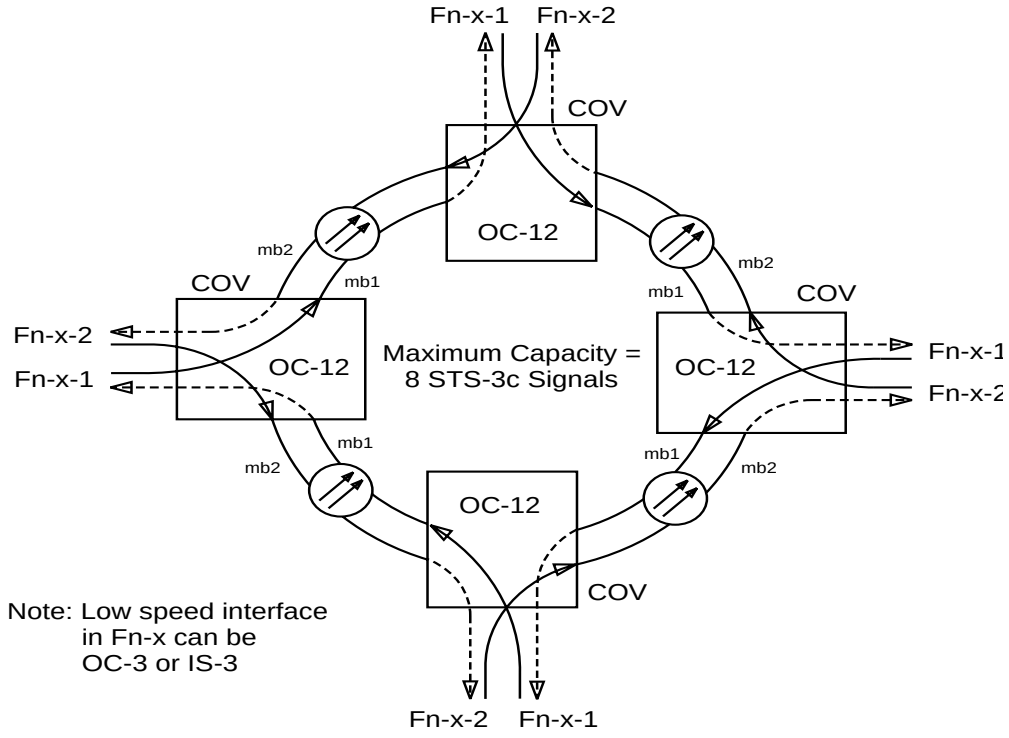


Figure 2-21. STS-3c Video Broadcast Application for ATM Interface

* Customer experience with this application has revealed compatibility issues with some brands of ATM equipment (e.g., Cisco, Bay Network). For ATM support it is strongly recommended to use the STS-3c 0x1 application features provided in OC-12 Release 5.2 and later ring releases, unless an unprotected scheme is acceptable.

Locked STS-3c (0x1) Broadband Services

Beginning with Release 5.2 the DDM-2000 OC-12 ring will transport STS-3c 0x1 services through OC-3/IS-3 interfaces in its function units. These interfaces must be provisioned as 0x1.

STS-3c path switching does not take place on the DDM-2000 OC-12 ring; it is executed elsewhere in the network (e.g., when the OC-12 ring transports ATM STS-3c traffic path switching is performed through the external ATM-based router).

Figure 2-22 shows an STS-3c 0x1 application. Each OC-12 node provisions the same dropped STS-3c time slot as other nodes on the same ring. For different applications, an OC-12 node can assign the other STS-3cs to different time slots at different sites. With 0x1 applications the OC-12 ring passes the contents of these STS-3c time slots between the low-speed OC-3/IS-3 lines and the OC-12 high-speed lines without terminating them or performing path protection switching.

Since the STS-3c traffic is received by the low-speed interfaces and transmitted as two copies on the OC-12 ring (one clockwise, one counterclockwise), the ring capacity is limited to the OC-12 line rate.

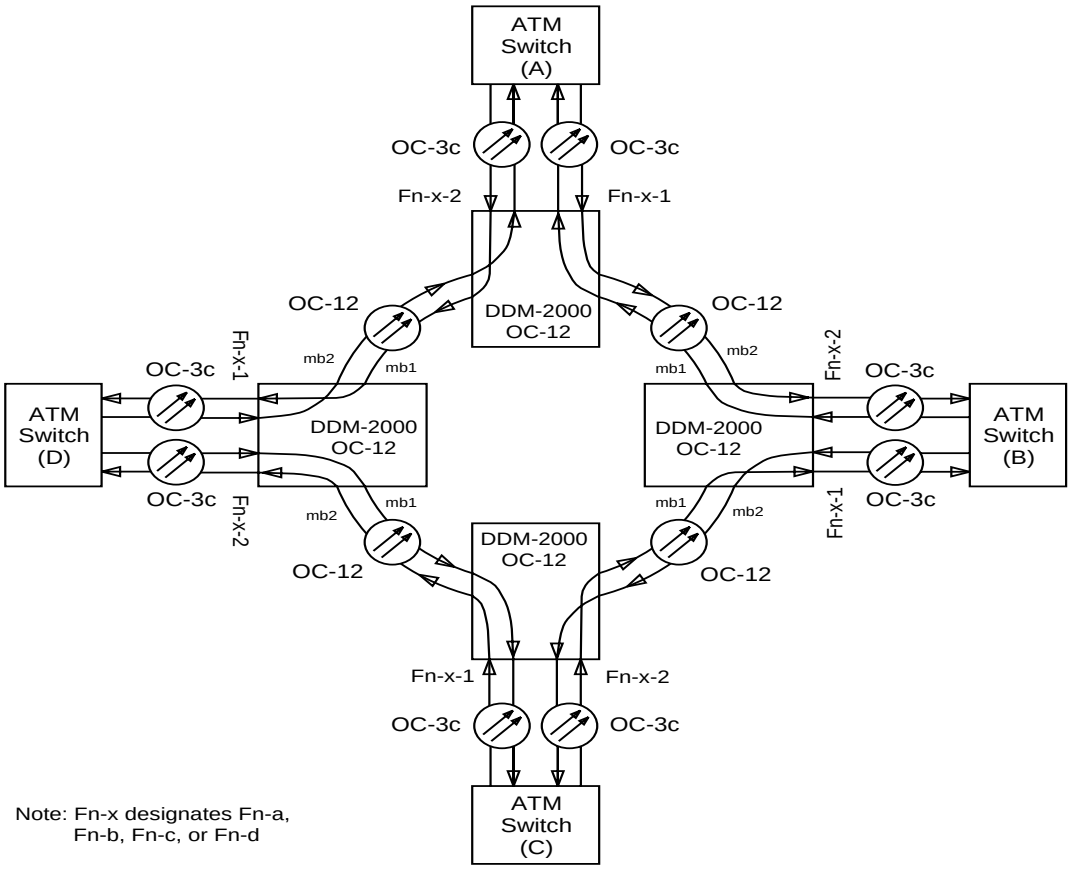


Figure 2-22. Locked (0x1) STS-3c - Broadband Services

Teleprotection and Supervisory Control and Data Acquisition (SCADA) Applications

Electric utilities are facing an unprecedented demand for increased communications bandwidth to support modern operations and business applications such as substation automation, computer networking, and video teleconferencing. Many electric utilities are installing SONET fiber optic backbones to meet these needs. SONET fiber optic backbones are a valuable communications resource that can also be used for real time protective relay and SCADA applications.

DDM-2000 OC-3, DDM-2000 OC-12, and DDM-2000 FiberReach Multiplexers can be used in a flexible backbone network among electrical substations and other important sites. These systems provide an innovative "locked cross-connection" feature that enhances the ability of SONET rings to transport protective relay and SCADA communications. The locked cross-connection feature meets the teleprotection requirements for minimum and stable transmission delay, minimum system outage during a protection switch, and DS0 level bandwidth management at all ring nodes.

The locked cross-connection feature allows a DS1 to be removed from the TR-496 compliant VT path protection switching algorithm and provisioned as an unprotected path between any two nodes on the ring. As shown in Figure 2-23, locked cross-connection can be used to interconnect adjacent nodes all the way around SONET rings, thereby permitting access to the DS1 at each SONET node. Figure 2-23 shows a single DS1 locked between ring nodes, but this can be extended to an arbitrary number of DS1s within the available SONET bandwidth. This locked cross-connection feature fixes the ring rotation (and delay) of the DS1 paths on the ring and also permits DS0 grooming of the DS1s at each DDM-2000 or DDM-2000 FiberReach node using an external drop/insert multiplexer, such as the RFL 9001 Intelligent Multiplexer. Figure 2-23 shows the DDM-2000 interconnecting at the DS1 level with an adjacent RFL 9001 Intelligent Multiplexer that, in turn, connects on the low-speed side to protective relay and SCADA equipment. Specially designed channel units in the RFL 9001 Intelligent Multiplexer detect when a fault occurs on the power line or substation and communicate at the DS0 level with other substation nodes to isolate the power grid fault.

In addition to the efficient DS0 grooming capability, the RFL 9001 Intelligent Multiplexer implements its own protection algorithm that can restore the DS0 level circuits within the locked cross-connections should the ring be cut. This algorithm operates much faster than the SONET TR-496 algorithm, thereby minimizing system outage during a protection switch.

Figure 2-23 also shows an optical drop/insert DS1 extension from the SONET rings implemented with RFL 9001 Intelligent Multiplexers. This extension is useful for serving low bandwidth sites remote from the SONET backbone. The figure shows a single host DDM-2000 interconnecting the rings, but the application could be a DRI to provide node survivability.

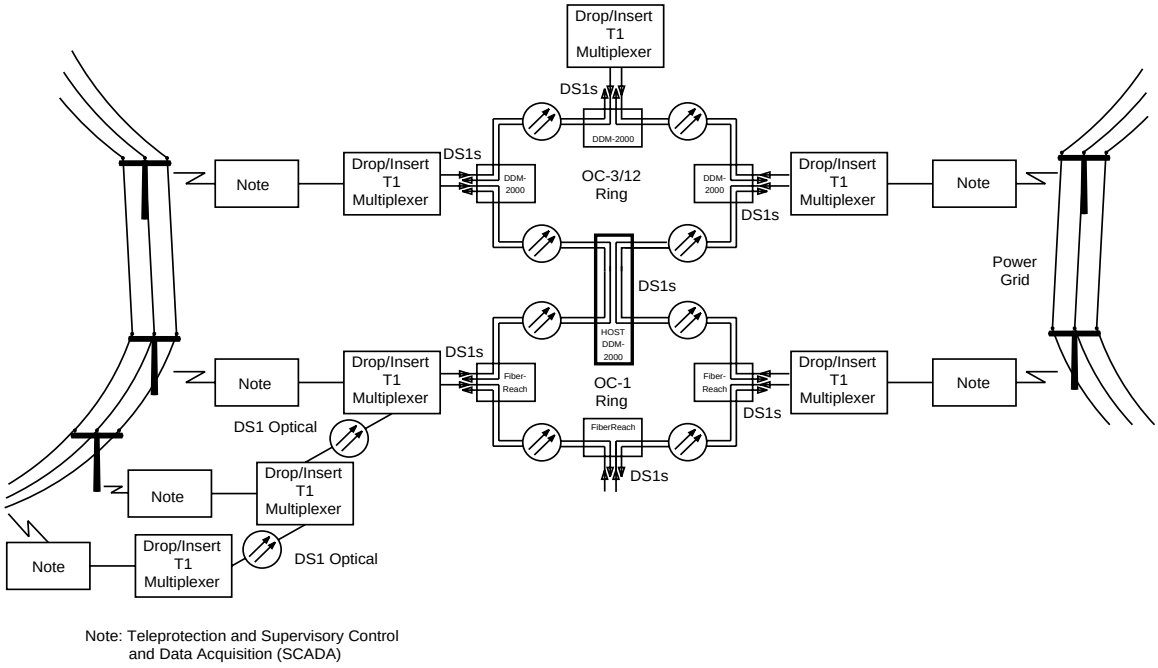


Figure 2-23. Teleprotection and SCADA Application

Intelligent Vehicle Highway System (IVHS) Applications

IVHSs are beginning and will grow to play a major role in the roadway systems of the future. Their primary use in the near-term is to reduce congestion. This is done in several ways.

- The IVHS provides more efficient and optimal traffic management which attempts to avoid congestion in the first place.
- The IHVS provides better management of congestion caused by random occurrences such as accidents or breakdowns.
- The IVHS eliminates many of the foreseeable causes of congestion, such as toll-taking, by automating these functions.

In the future, these systems will also help travelers plan their routes by providing up-to-the-minute traffic and highway information. The DDM-2000 OC-3 and OC-12 Multiplexers are a perfect match for the networking needs of these systems.

Figure 2-24 shows a typical IVHS application. An IVHS network calls for carrying data between roadside equipment, such as traffic counters, speed sensors, variable messaging signs, video cameras, toll-taking equipment, pay phones and call boxes, and a traffic operations center where incoming data is processed and responses are generated. The DDM-2000 OC-3 and OC-12 Multiplexers provide a perfect backbone for carrying this information. The DDM-2000 OC-3 Multiplexer SONET ring capability, when coupled with diverse fiber routing on opposite sides of the roadway, makes the backbone completely self-healing in the face of failures. Such reliability is absolutely essential, especially as travelers come to depend more and more on IVHS networks. The VT1.5 and STS-1 bandwidth management capabilities of the DDM-2000 OC-3 and OC-12 Multiplexers allow flexible allocation of bandwidth to match the dynamics of a roadway system, which is undergoing unpredictable changes in traffic patterns, breakdowns, accidents, and repairs. Such bandwidth management provides a system which meets the IVHS network needs in a cost-effective manner. DDM-2000 OC-3 and OC-12 Multiplexers completely meet the transmission needs of an IVHS network.

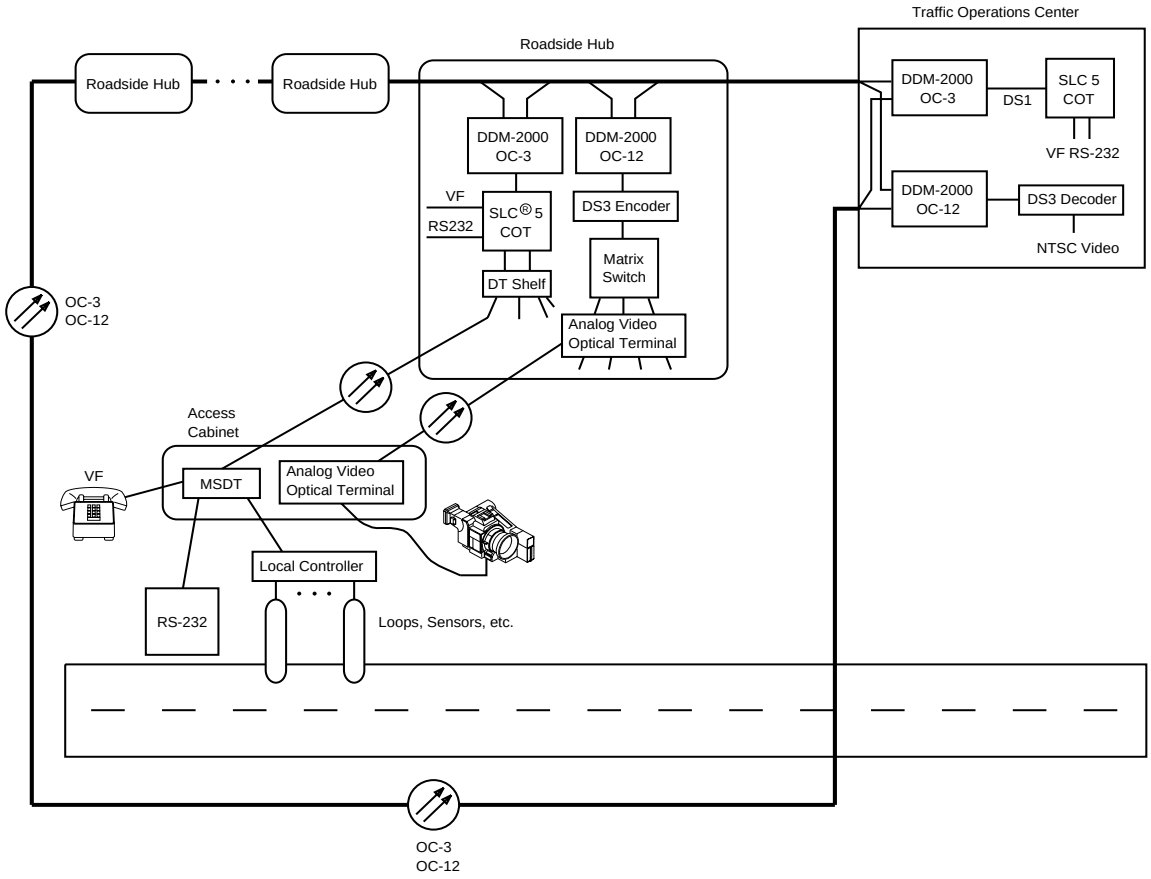


Figure 2-24. Intelligent Vehicle Highway System (IVHS) Application

Shelf Descriptions and Configurations

3

Table of Contents

Overview 3-1

DDM-2000 OC-12 Multiplexer Shelf 3-1

DDM-2000 OC-12 Multiplexer Shelf Configurations 3-7

- OC-12 STS-1 Path Switched Ring Shelf 3-9
- OC-12 STS-1/VT1.5 Path Switched Ring Configuration 3-10
- OC-3/IS-3 Dual Ring Interworking (DRI) Configuration 3-11
- OC-12 Ring Configuration (DS1/EC-1 Low-Speed Interfaces) 3-12
- OC-12 Optical Extension Shelf 3-13
- Linear (1+1) Extension From OC-12 Ring Configuration 3-14
- OC-12 Dual Homing Shelf 3-15
- OC-12 STS-3c Broadcast Shelf 3-16
- OC-12 OC-3c Transport Shelf 3-17

DDM-2000 Fan Shelf 3-18

Table of Contents

Shelf Descriptions and Configurations

3

Overview

This section provides the physical description of the DDM-2000 OC-12 Multiplexer shelf and illustrates typical shelf equipage for different configurations. In addition, this section provides a physical description of the DDM-2000 Fan Shelf.

DDM-2000 OC-12 Multiplexer Shelf

The DDM-2000 OC-12 Multiplexer is shown in Figure 3-1 and Figure 3-2. Figure 3-1 is the new Group 4 shelf. The Group 4 shelf measures 14 inches high by 21.25 inches wide by 13.25 inches deep and fits in a standard 23-inch wide bay. The Group 4 shelf replaces the Group 1 shelf for new applications (or existing applications). When using the G4 shelf with the alternative isolated grounding scheme, the BBG8B SYSCTL is required. The G4 shelf may be used with a traditional grounding scheme with any system controller circuit pack.

The Group 1 shelf measures 14 inches high by 21.25 inches wide by 12 inches deep and fits in a standard 23-inch wide bay. User panels are not interchangeable between shelves (old in the new or new in the old). If desired, a G1 shelf can be upgraded to provide the deeper front cover offered with the G4 shelf by ordering the Front Cover Upgrade Kit, comcode #847554185.

Each shelf is a stand-alone entity with its own fiber cabling and interfaces to DSX-3, STSX-1, office power, and operations interfaces. Cabling for office alarms, CIT interfaces, and DS1 timing inputs and outputs can be shared among other shelves in the bay. The default configuration provides rear access cabling. Front access through dangler cables is available as an option. Front-access optical connectors interconnect to fiber optic facilities and facilitate shelf loopback and fiber tests. The optical connectors are mounted on the OLIU circuit pack faceplate.

The DDM-2000 OC-12 Multiplexers provide Lucent's universal optical connector on all OLIUs. These OLIUs are designated by a -U. The universal optical connectors are receptacles on the faceplate of the OLIUs that allow a single OLIU to support either *ST*®, FC-PC, or SC connectors as needed.

A DDM-2000 OC-12 Multiplexer shelf consists of the following:

- 18 circuit pack slots
  - 2 four-inch slots
  - 9 eight-inch slots
  - 7 twelve-inch slots
- User panel
- Fully connectorized backplane
- Front and back covers.

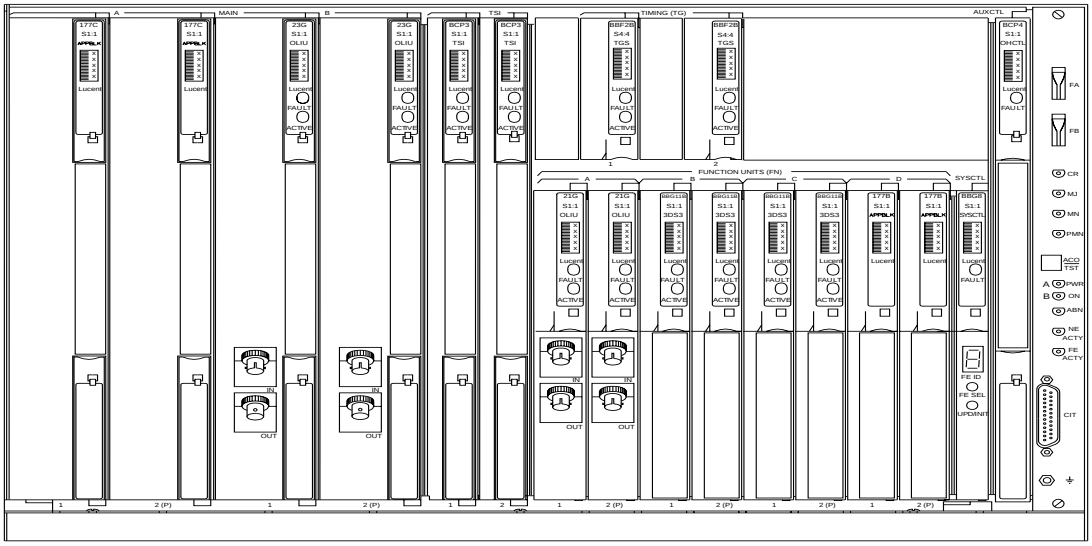


Figure 3-1. DDM-2000 OC-12 Shelf — Front View

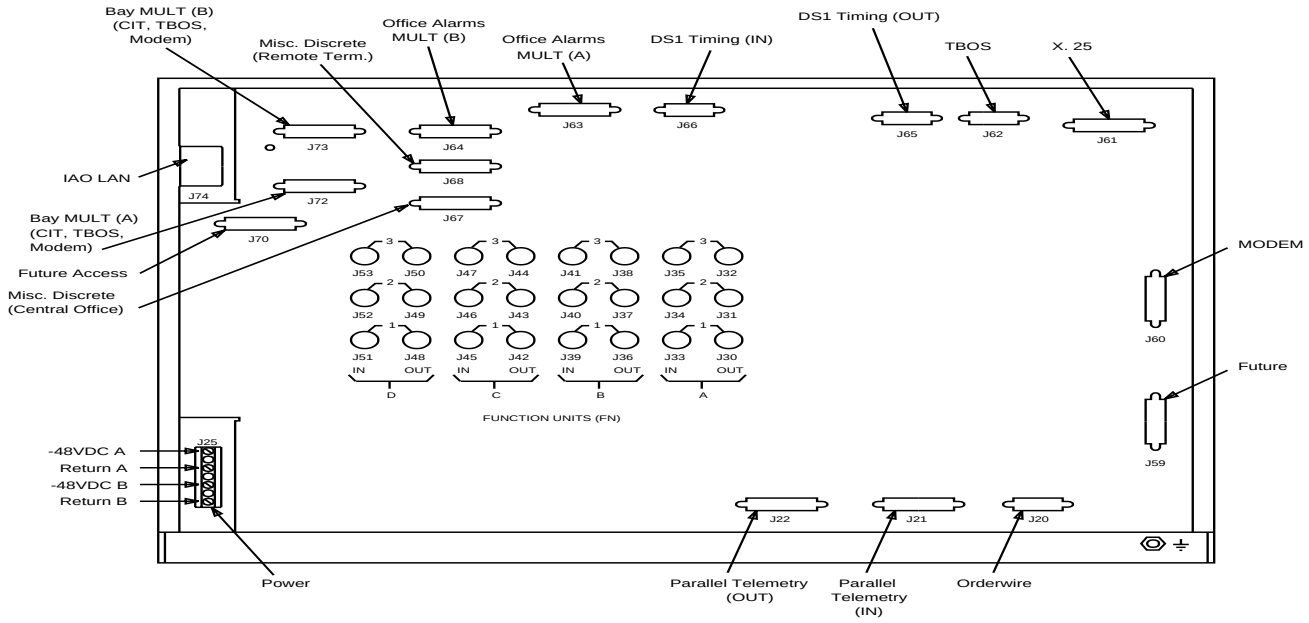


Figure 3-2. DDM-2000 OC-12 Shelf — Rear View

Table 3-1 lists the DDM-2000 OC-12 Multiplexer plug-ins.

Table 3-1. DDM-2000 OC-12 Plug-Ins

Product Code	Functional Name	Functional Designation
BBF2B	Synchronous Timing Generator	TGS
BBF4	Synchronous Timing Generator 3	TG3
BBG11/11B*	Triple DS3	3DS3
BBG12	Triple EC-1 Interface	3STS1E
BBG8	System Controller	SYSCTL
BCP3	Time Slot Interchange Flex	TSI FLEX
BCP4	Overhead Controller	OHCTL
21D-U	IS-3 OLIU	OLIU
21G-U	OC-3 OLIU	OLIU
23G/23G-U	OC-12 OLIU	OLIU
23H/23H-U	OC-12 1550 nm OLIU	OLIU
177B	Apparatus Blank (8")	APPBLK
177C	Apparatus Blank (12")	APPBLK

* BBG11B DS3 circuit pack is required for enhanced DS3 performance monitoring.

As shown in Figure 3-1, the front view of the shelf is divided into seven functional groupings:

- Starting from left to right:
  - MAIN
  - TSI (Time Slot Interchange)
  - TIMING (TG)
  - AUXCTL
  - USER PANEL
- Continuing below the TIMING area:
  - FUNCTION UNITS (FN)
  - SYSCTL.

Four 12-inch slots, designated MAIN, are for the main OC-12 OLIU circuit packs. These circuit packs are arranged in two service and protection pairs designated main A and main B. Main A slots 1 and 2(P) must be equipped with 177C apparatus blanks (APPBLK) except when the shelf is used as an OC-12 Regenerator shelf.

Two 12-inch slots, designated TSI, are for two time slot interchange (TSI) circuit packs.

Two 4-inch slots, designated TG, are for two timing generator packs (TGS/TG3), service and protection.

One 12-inch slot, designated AUXCTL, is for the overhead controller (OHCTL) circuit pack.

Eight 8-inch slots, designated FN, are for function unit circuit packs. These slots are divided into four groups designated A, B, C, and D. The FN slots can be equipped interchangeably by group, with service and protection.

One 8-inch slot, designated SYSCTL, is for the main controller circuit pack (SYSCTL).

The user panel mounted on the far right side of the shelf consists of the following:

- Two –48 volt fuses (10A)
- Four alarm LEDs
- ACO/TEST pushbutton control
- Five status LEDs
- CIT port
- ESD jack.

Accidental insertion of same-size circuit packs in incorrect slots is prevented through circuit pack keying. The key mechanism is located on the faceplate latch, with an interference mechanism on the shelf.

As shown in Figure 3-3, the front of the shelf is covered with an electromagnetic compatibility (EMC) cover. If the shelf needs to be accessed for maintenance activities, the cover is hinged to drop down 180 degrees or it can be easily removed by pulling out when at 45 degrees. The rear of the shelf is covered over the DS3 interface connectors and shelf cables. All covers are necessary to meet the EMC guidelines set by the Federal Communications Commission (FCC).

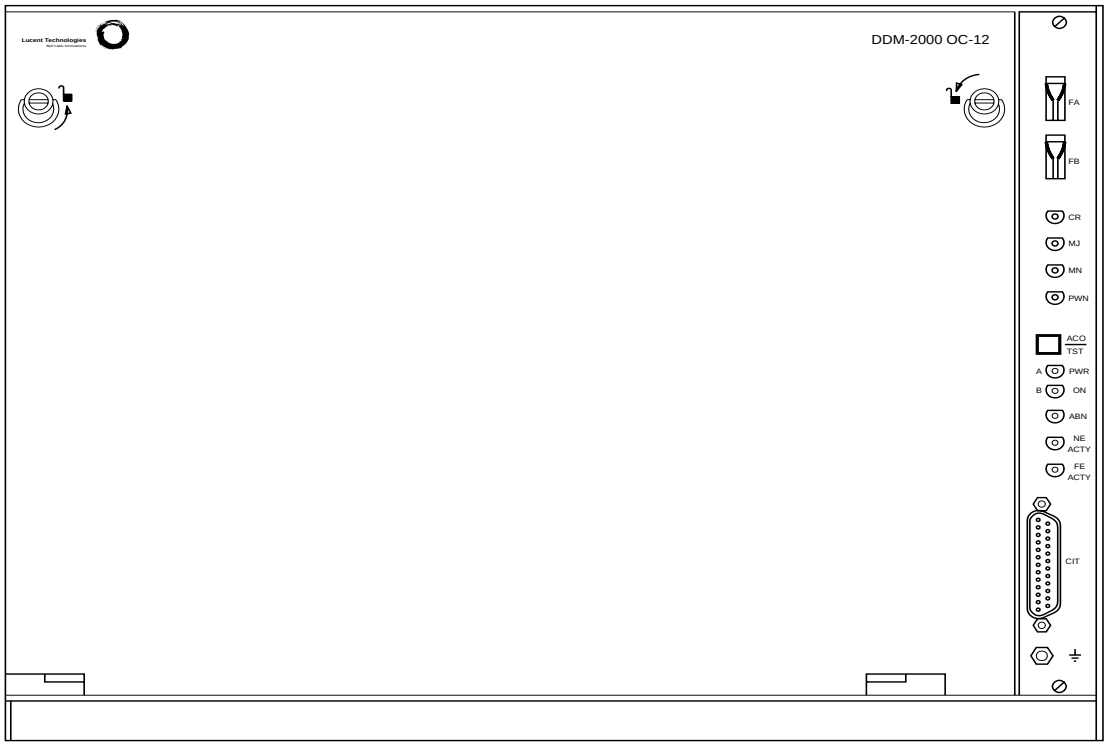


Figure 3-3. DDM-2000 OC-12 Front Panel

DDM-2000 OC-12 Multiplexer Shelf Configurations

A DDM-2000 OC-12 Multiplexer path switched ring shelf supports all OC-12 ring applications.

- The following circuit packs are required in all DDM-2000 OC-12 Multiplexer path switched ring applications:
  - 177C APPBLK in the main A slots to control air flow through the shelf to ensure adequate cooling.
  - 23G/23G-U or 23H/23H-U OLIU circuit packs in the main B slots provide the OC-12 optical interfaces.
  - BCP3 TSI circuit packs in the TSI slots connect STS-1s from the main B slots to the FN slots. The BCP3 TSI also distributes the timing it receives from the BBF2B/BBF4 TGS/TG3 circuit packs to circuit packs in the main and FN slots.
  - BBF2B/BBF4 TGS/TG3 circuit packs in the TIMING slots provide timing to the BCP3 TSI circuit packs.
  - BBG8 SYSCTL and BCP4 OHCTL circuit packs in the SYSCTL and AUXCTL slots, respectively, provide system control functions.
- For all but the SYSCTL and OHCTL, which are not protected, installation of protection circuit packs is optional. Equipage of function unit slots depends on the application.
- Unused FN slots must be equipped with 177B APPBLK to ensure adequate cooling of the shelf.
- All applications should be equipped with a baffle as shown in ED-8C727-10.

Table 3-2 lists the possible circuit pack equipage mapped by release. See Section 7, "Circuit Pack Descriptions," for more information on these and other circuit packs. Some shelf configurations are described in the following sections.

Use the table in the following way: Pick one circuit pack from each column to build an application. Any combination of BBG11/11B, BBG12, 21D-U, or 21G-U/ 21G2-U OLIUs are allowed in the FN slot. Provisioning rules require that both slots of a 1X1 pair have the same circuit pack type. For multiple OLIU circuit pack types, these units can be mixed if they follow the provisioning rules.

Table 3-2. DDM-2000 OC-12 Multiplexer Circuit Pack and Software Compatibility Matrix

Release Number	Slot Name						
	Main-A	Main-B	TSI	TG	FN	SYSCTL	AUXCTL
7.0, (Ring)	177C	23G/23G-U 23H/23H-U	BCP3	BBF2B BBF4	21G/21G-U/ 21G2-U 21D/21D-U BBG11/11B* BBG12 177B	BBG8	BCP4

***** BBG11B DS3 circuit pack required for enhanced DS3 performance monitoring.

OC-12 STS-1 Path Switched Ring Shelf

Figure 3-4 shows a DDM-2000 OC-12 Multiplexer shelf equipped for an STS-1 path switched ring application. One pair of OC-12 OLIU circuit packs are located in the main B slots. The TSI slots must be equipped with TSI FLEX circuit packs. The function units can be equipped with triple STS1E, triple DS3, or OC-3 circuit packs. Figure 3-4 shows a configuration that supports up to three STS-1 and three DS3 interfaces and two OC-3 optical extensions. The optical extension OLIUs can provide transport for either three independent STS-1s or one STS-3c. Dual ring interworking (DRI) capabilities are available on STS-1 paths dropped by the 3STS1E interfaces.

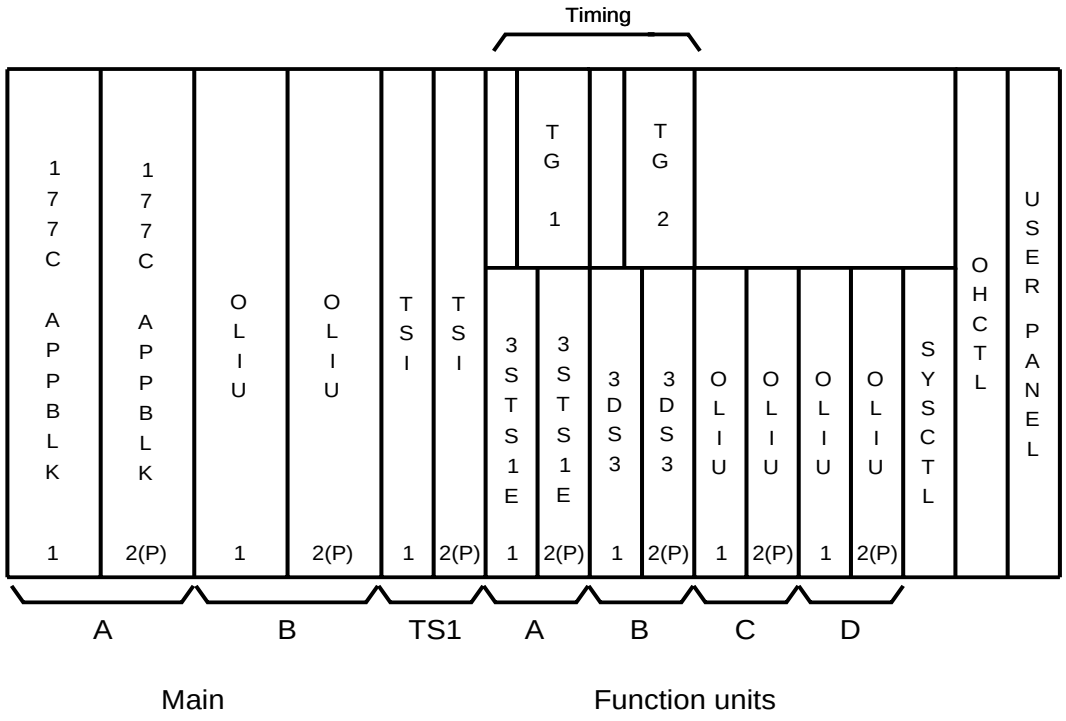


Figure 3-4. OC-12 STS-1 Path Switched Ring Shelf

OC-12 STS-1/VT1.5 Path Switched Ring Configuration

Figure 3-5 shows a DDM-2000 OC-12 Multiplexer STS-1/VT1.5 path switched ring configuration. As in the DDM-2000 OC-12 Multiplexer STS-1 ring shelf, there is one set of OC-12 interfaces and a pair of TSI FLEX circuit packs. In this configuration, however, there is also an IS-3 interface to a DDM-2000 OC-3 Multiplexer shelf where VT1.5 level path protection switching is completed. This interface between DDM-2000 OC-3 and OC-12 Multiplexers is referred to as a "0x1" interface. In this case, the DDM-2000 OC-12 Multiplexer feeds the STS-1 paths directly from the two rotations of the OC-12 ring to the OC-3 shelf. Protection switching is done on the OC-3 Multiplexer shelf. The remaining function units can be equipped with 3DS3, 3STS1E, or OLIU circuit packs as desired. OLIUs can be used for optical extensions as in the OC-12 Multiplexer STS-1 level path switched ring for interconnection to additional DDM-2000 OC-3 Multiplexer shelves performing VT1.5 level path switching.

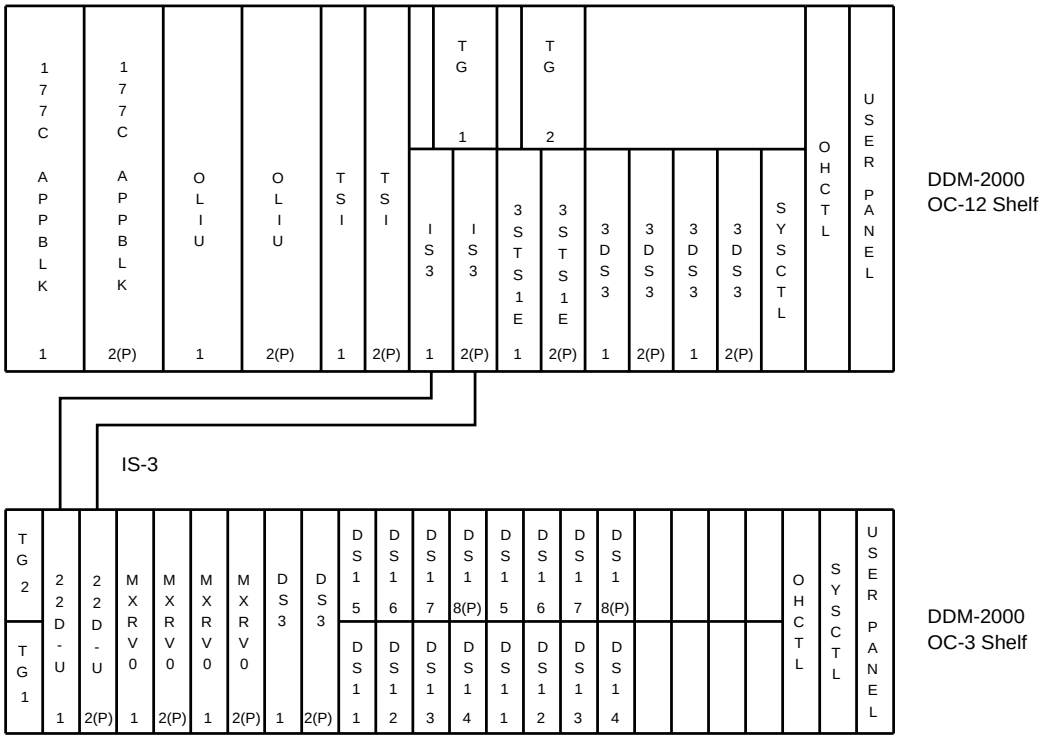


Figure 3-5. OC-12 STS-1/VT1.5 Path Switched Ring Configuration

OC-3/IS-3 Dual Ring Interworking (DRI) Configuration

Figure 3-6 shows a DDM-2000 OC-12 Multiplexer OC-3/IS-3 DRI configuration. The IS-3 interface provides a more economical way than three EC-1 interfaces to provide optical connectivity over a limited distance between an OC-3 ring and an OC-12 ring. Each IS-3 interface can connect one OC-3 node to an OC-12 node.

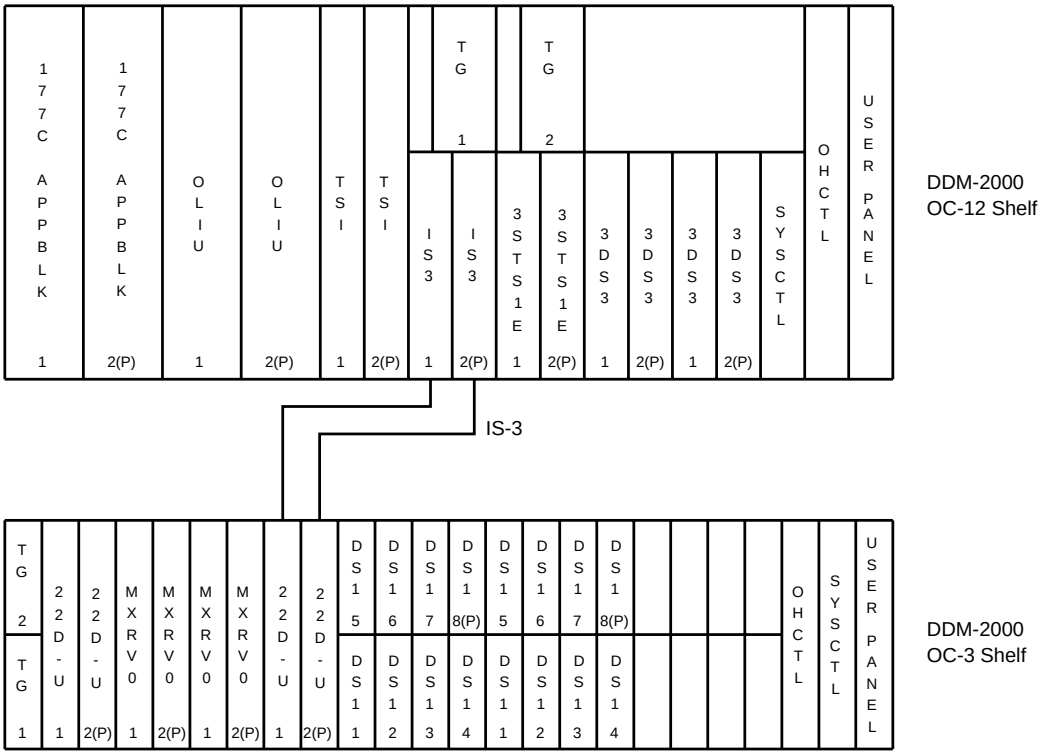


Figure 3-6. OC-3/IS-3 Dual Ring Interworking Configuration

OC-12 Ring Configuration (DS1/EC-1 Low-Speed Interfaces)

Figure 3-7 shows an OC-12 configuration using DS1/EC-1 low-speed interfaces. Interface to the low-speed shelf is made through the IS-3 (or OC-3) circuit packs, one service and one protection pack per interface. The IS-3 circuit packs replace the OLIU circuit packs in the main slots on the DDM-2000 OC-3 shelf. This configuration supports a high-speed OC-12 interface with 84 DS1 terminations per DDM-2000 OC-3 shelf, up to a maximum of 336 DS1 terminations.

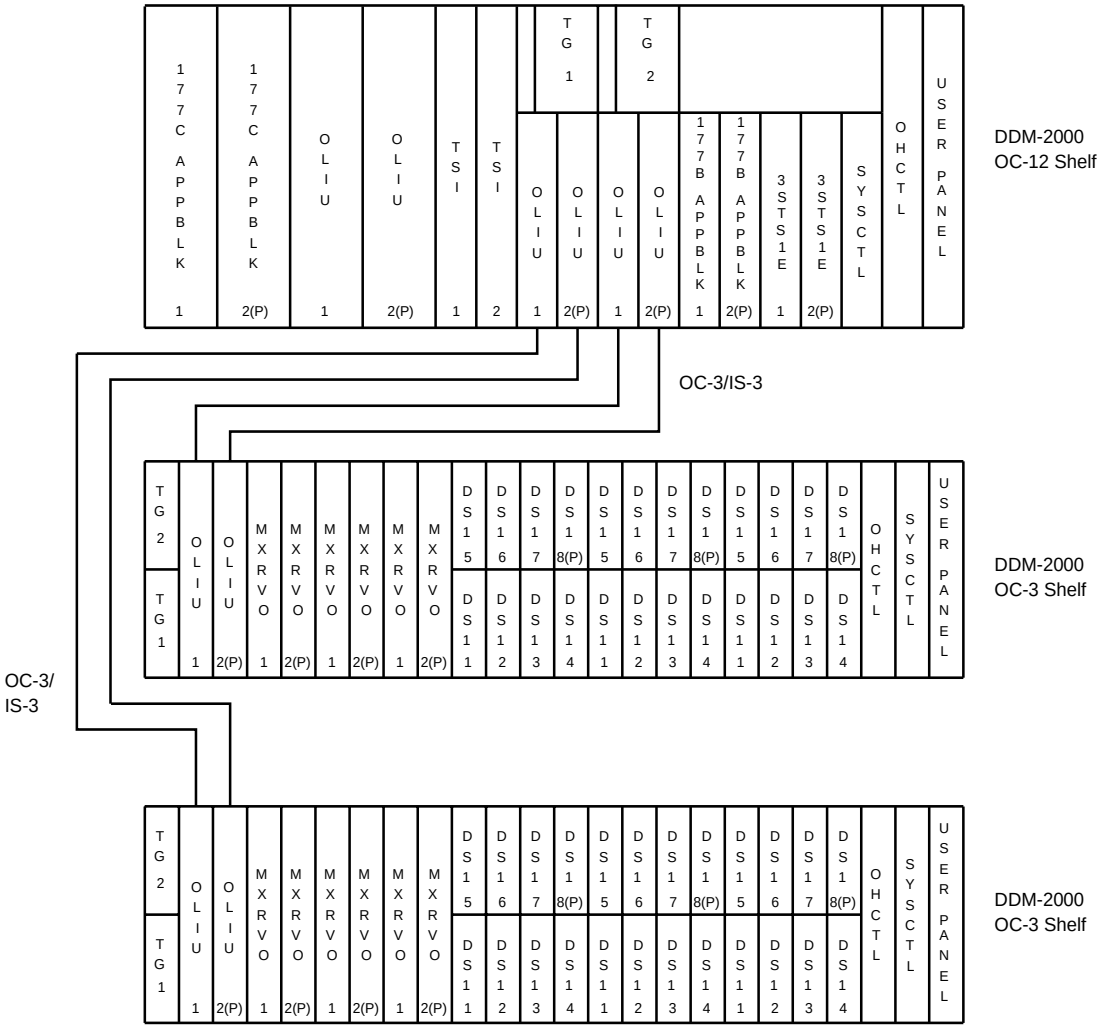


Figure 3-7. OC-12 Ring Configuration (DS1/EC-1 Low-Speed Interfaces)

OC-12 Optical Extension Shelf

Figure 3-8 shows an OC-12 optical extension shelf. The eight low-speed interfaces are equipped with four service and four protection OC-3 circuit packs. This configuration supports four OC-3 optical extensions; however, local drop configurations can be established by replacing OC-3 circuit packs with triple DS3, triple STS1E, or IS-3 circuit packs. This configuration can also support up to four OC-3 optical extensions through proper provisioning.

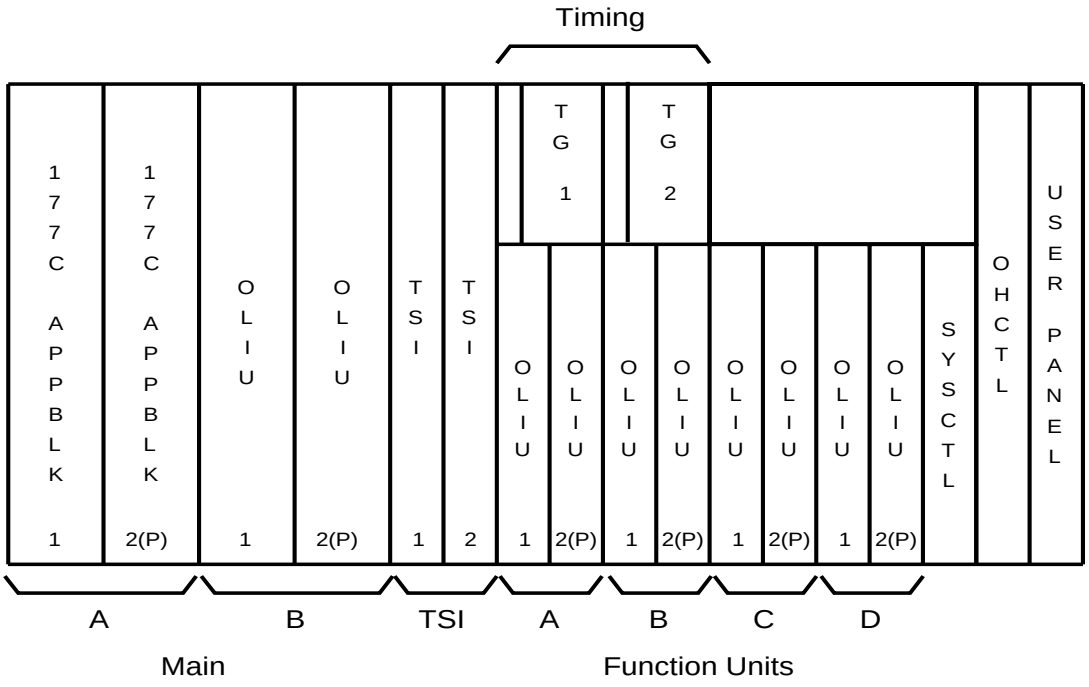


Figure 3-8. OC-12 Optical Extension Shelf

Linear (1+1) Extension From OC-12 Ring Configuration

Figure 3-9 shows a DDM-2000 OC-12 Multiplexer shelf provisioned for interfacing to an OC-3 network extension. Two levels of switching are used. STS-1 level switching on the OC-12 ring to establish the STS-1 path and linear (1+1) switching of the service and protection lines on the OC-3 linear extension.

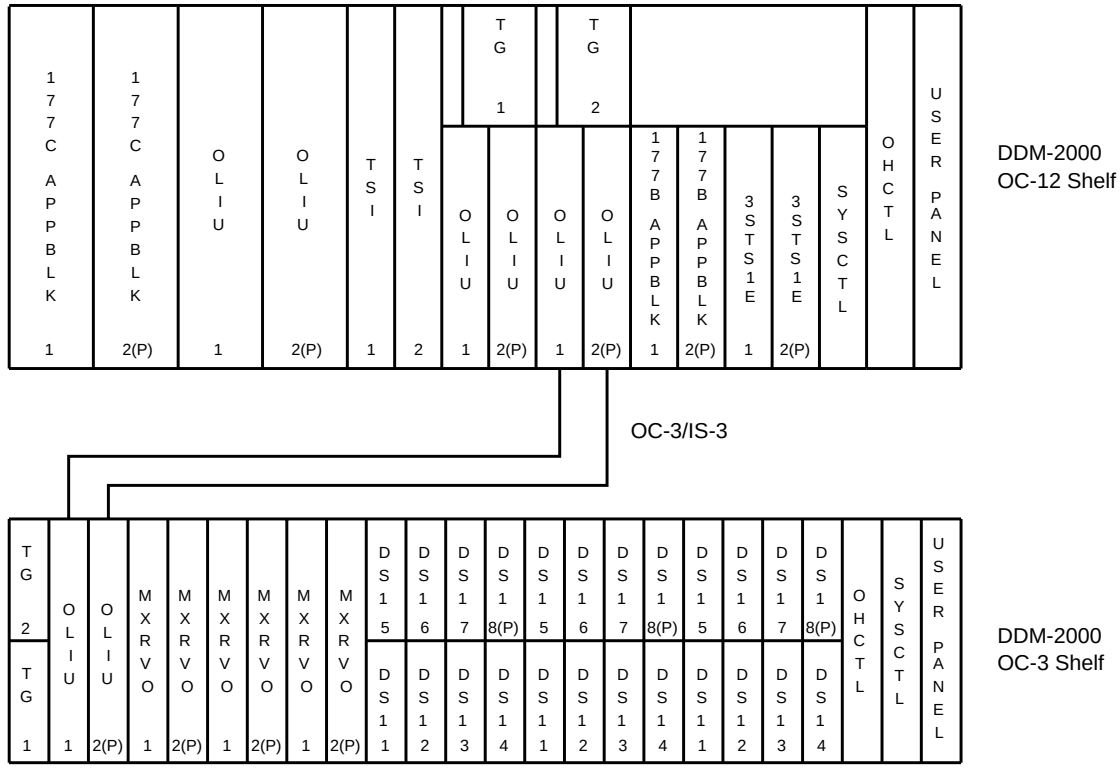


Figure 3-9. Linear (1+1) Extension From OC-12 Ring Configuration

OC-12 Dual Homing Shelf

Figure 3-10 shows a DDM-2000 OC-12 shelf equipped for a dual homing configuration, allowing two hosts to be active on the same OC-12 ring. This allows a 0x1 application where traffic is routed to both hosts to provide host protection. In this application, two DDM-2000 OC-12 shelves are hosting one OC-3 ring. Note that for single homed 0x1 applications, both function unit slots must be equipped while, for dual homed 0x1 applications, one function unit slot must be empty.

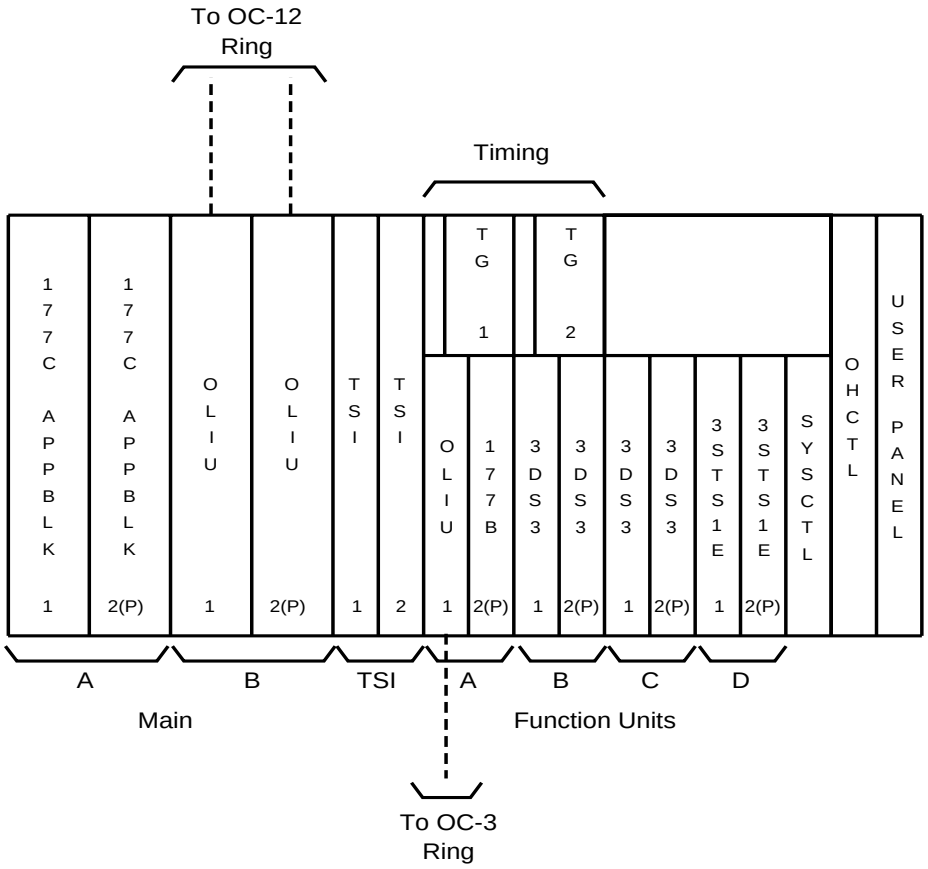


Figure 3-10. DDM-2000 OC-12 Dual Homing Shelf

OC-12 STS-3c Broadcast Shelf

Figure 3-11 shows a DDM-2000 OC-12 CO shelf equipped for an STS-3c broadcast application. This configuration uses a pair of OC-3cs provisioned for video. Each OC-3c is split and fed onto different rotations of the ring. There is no protection switching between the function unit circuit packs (unprotected). Each drop (RT) location can be provisioned to drop any or all of the STS-3cs to OC-3 or IS-3 circuit packs. Bandwidth on the ring, not provisioned for this application, can be used for other path-switched ring applications as shown in the figure with 6 DS3s and 3 EC-1s. This configuration also supports Locked STS-3c Broadband Services.

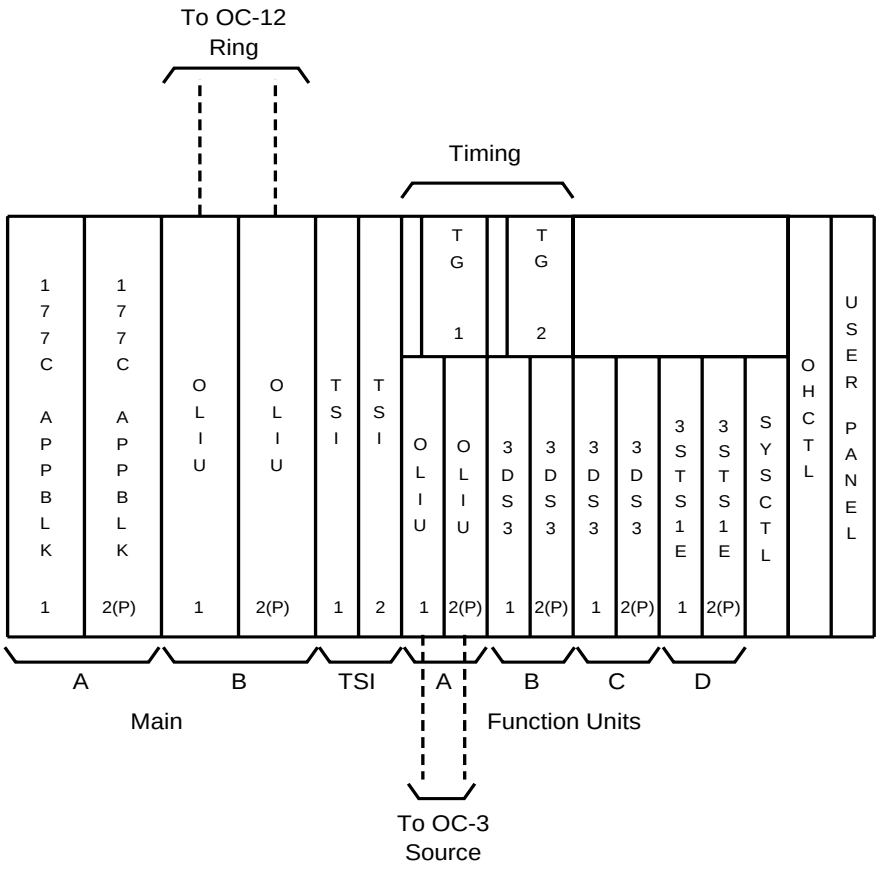


Figure 3-11. DDM-2000 OC-12 STS-3c Broadcast Shelf

OC-12 OC-3c Transport Shelf

Figure 3-12 shows a DDM-2000 OC-12 shelf equipped for an OC-3c transport application. The main application of a shelf, configured in this way, is transport of video or asynchronous transfer mode (ATM) signals. Bandwidth is mapped into STS-3c "bundles," and the bundles follow the same path to preserve the isochronous (known, periodic time interval) nature of the transported information.

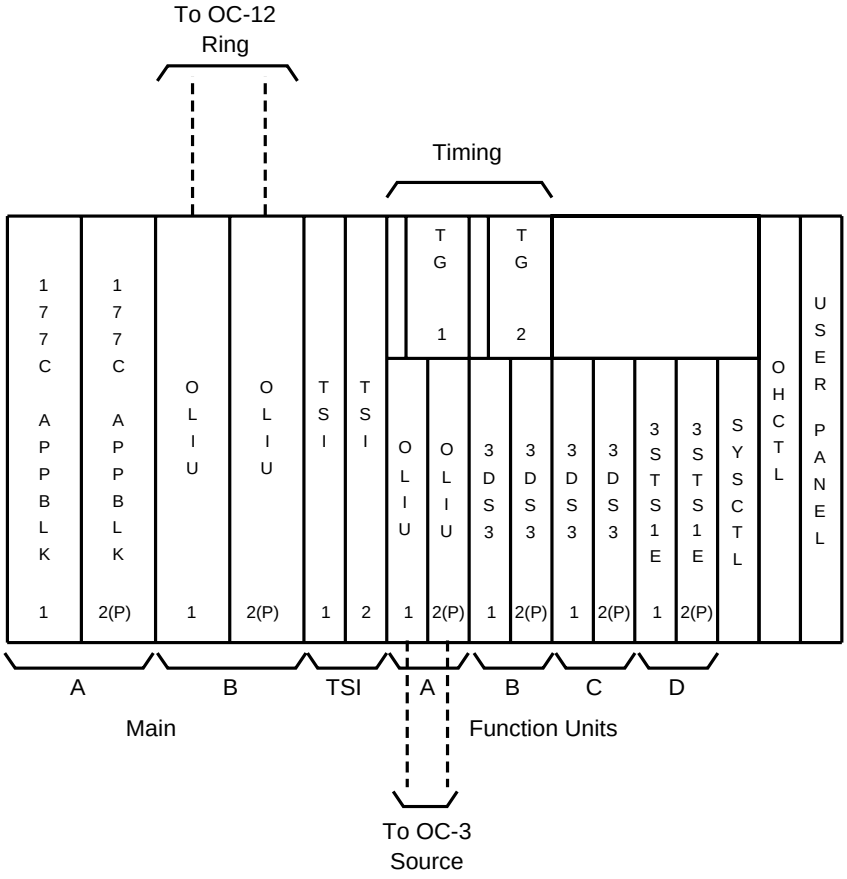


Figure 3-12. DDM-2000 OC-12 OC-3c Transport Shelf

DDM-2000 Fan Shelf

The DDM-2000 Fan Shelf (Figure 3-13) provides forced convection cooling to DDM-2000 OC-12 shelves in controlled environments (central office and controlled environment vault).

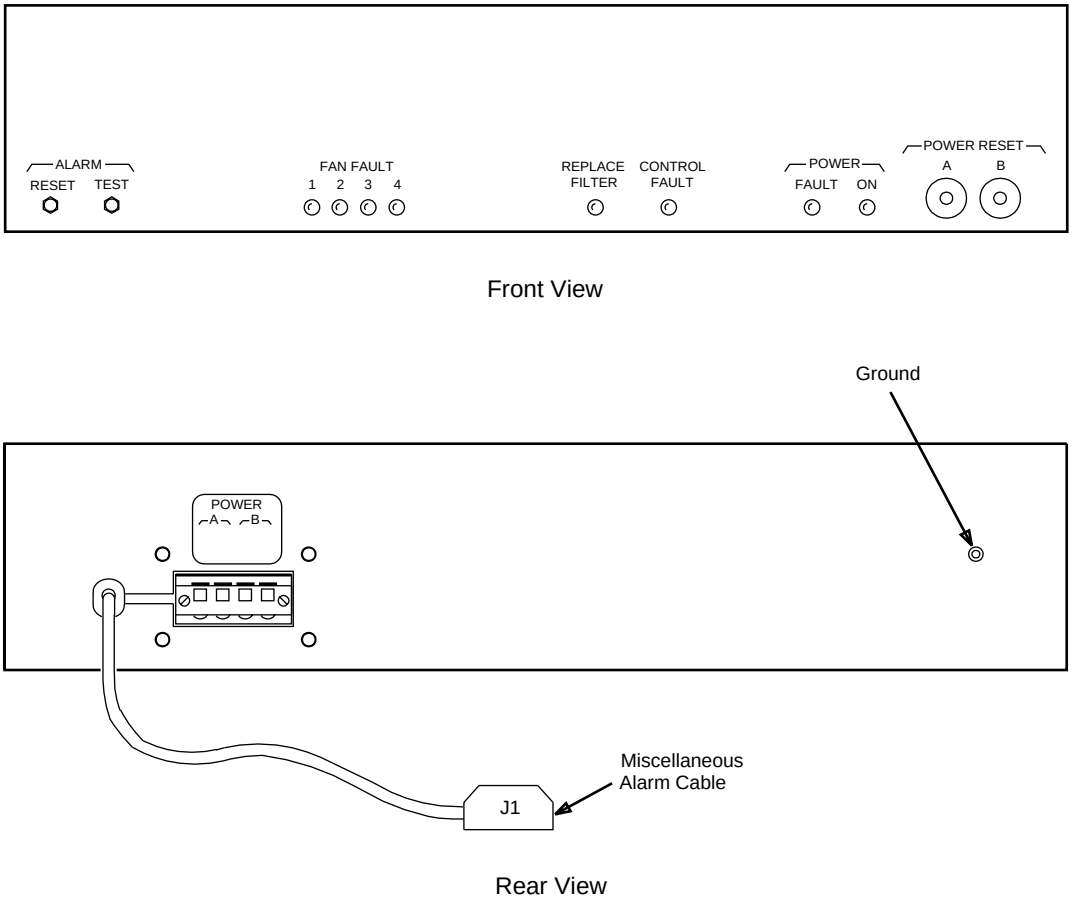


Figure 3-13. DDM-2000 Fan Shelf

The fan shelf is required in all DDM-2000 OC-12 Multiplexer applications in a controlled environment. The fan shelf is not required in OC-12 Regenerator applications. All applications should be equipped with a heat baffle as shown in ED-8C727-10 for the DDM-2000 OC-12 Multiplexer and OC-12 Regenerator shelves.

A DDM-2000 Fan Shelf is required for each DDM-2000 OC-12 shelf.

The fan shelf is 3.9 inches high by 9.3 inches deep by 21.2 inches wide and weighs 25 pounds. Mounting brackets can be attached in three positions to accommodate both front and rear access installations in different bay frames. The fan shelf is fully accessible from the front for service and maintenance.

When the front cover is removed, the four fan units and a 4-part switch to the left of center on the front of the shelf are visible (see Figure 3-14). The switches should be set as shown in Table 3-3.

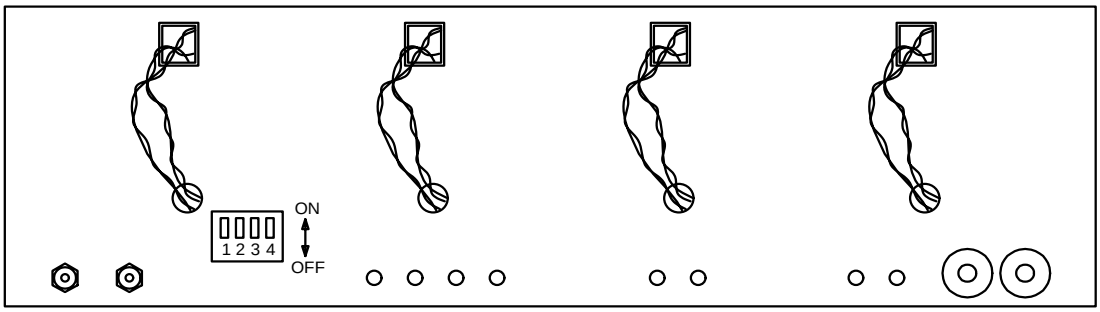


Figure 3-14. DDM-2000 Fan Shelf — Fan Switches — Front Cover Removed

Table 3-3. DDM-2000 Fan Shelf Switch Settings

Cooling Arrangement	Set Point	Switch Settings			
		S1	S2	S3	S4
DDM-2000 OC-12	400 fpm	on	off	on	on

The four fan units are independent of each other; any of them can be removed by removing the connectorized fan cord and the screws that hold the fan unit in the shelf.

A filter must be installed on the bottom of the DDM-2000 OC-12 shelf. The filter is secured by spring clips that hold it in place.

A terminal block is provided for the direct termination of the two –48 V power feeders. If direct termination is not needed, optional cable assemblies are available (in DDM-2000 OC-12) to connect the power feeders from the DDM-2000 bay power cables to the terminal strip on the rear of the fan shelf. A dangler cable provides an alarm interface so that fan shelf alarms can be reported through an associated DDM-2000 system. The alarm output is a dry contact closure. It is activated whenever a fault is detected on the fan shelf and whenever one or both –48 V power feeders fail. Alarm and power cable openings are provided for both rear and front access installations. A ground stud is provided on the left rear of the fan shelf to meet the UL grounding requirements for rear and front access applications. Two ground cables are provided with the fan shelf, one 6-inch cable for rear access applications and one 18-inch cable for front access applications. To reach the front of the fan shelf, the 18-inch front access ground cable must go through the rear cable access opening, through the fan shelf, and exit from the right front cable access opening.

The following pushbuttons and LEDs are accessible through the front cover of the fan shelf:

- The ALARM RESET pushbutton near the left side of the front of the shelf is used to reset fan shelf alarms and register a new combination of set-point switch settings. Once a fan shelf alarm is turned on, it can be reset only by clearing the trouble condition and then pressing the ALARM RESET pushbutton.
- The ALARM TEST pushbutton provides a test of the fan shelf alarms. When pressed and held, all LEDs except the CONTROL FAULT LED and POWER FAULT LED will be lit. After a test is done, the ALARM RESET pushbutton must be pressed to turn the LEDs off. This is a local test; the alarm on the fan shelf alarm interface is not activated.
- Four red FAN FAULT LEDs indicate faults in each of the four independent fan units.
- The red FILTER REPLACE LED indicates that it is time to replace the filter.
- The red CONTROL FAULT LED indicates a fault in the fan shelf monitoring and control system.
- The red POWER FAULT LED indicates a failure in one of the –48 V power feeders.
- The green POWER ON LED indicates that the fan shelf is receiving power from one of the two –48 V power feeders.
- Two pushbutton circuit breakers are located near the right side of the front of the shelf.

Power

4

Table of Contents

Overview 4-1

Introduction 4-1

Power Description 4-2

- Circuit Packs 4-3
  - OLIU Circuit Packs 4-3
  - TSI, TGS/TG3, 3DS3, and 3STS1E Circuit Packs 4-3
  - Control Circuit Packs 4-3
- LEDs 4-4
- Power Minor Alarm 4-4
- Power Distribution 4-5

Table of Contents

Power

4

Overview

This section describes the power distribution of the DDM-2000 OC-12 Multiplexer.

Introduction

The DDM-2000 OC-12 Multiplexer is powered by –48 volts direct current. The voltages required to power the circuits within the DDM-2000 OC-12 Multiplexer are generated by DC-to-DC converters mounted on circuit packs within the shelf.

The information in this section is for typical applications only. Refer to Section 10, "Technical Specifications," and 801-525-168, *DDM-2000 Floor Plan Data Sheets,* and T-82046-30, Power Systems DC Distribution Circuit for Digital Transmission System, for proper engineering of battery plant and feeders for OC-12 Systems.

Power Description

Two independent –48 volt office power feeders (A and B) enter the shelf through backplane connectors and are fused and filtered at the user panel, then distributed to the circuit packs. Power conversion is performed through modular power converters located on the circuit packs. In each circuit pack, the two feeders are diode ORed, fused, filtered, and regulated by the board-mounted power modules. This provides the required redundancy in case of the loss of one feeder or one fuse. Figure 4-1 shows which circuit packs have converters mounted on the printed wiring boards. Power modules are located on the OLIU, 3DS3, 3STS1E, TSI, TG, SYSCTL, and OHCTL circuit packs.

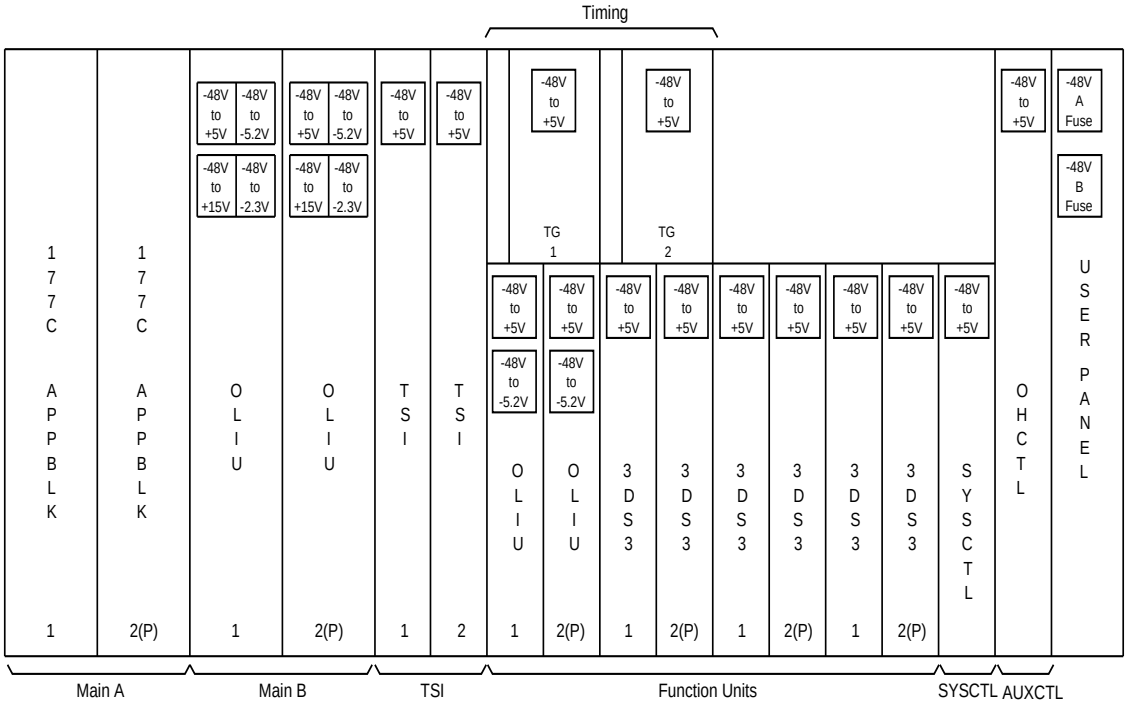


Figure 4-1. DDM-2000 OC-12 Multiplexer Power Architecture

Circuit Packs

OLIU Circuit Packs

The 21D/21D-U OLIU circuit pack is powered by a –48 volt to +5 volt DC-to-DC converter mounted on the circuit pack. The backplane power feeders supply A and B –48 volts to this converter via diode ORed circuits and fuses mounted on the circuit pack.

The 21G/21G-U OLIU circuit pack is powered by two DC-to-DC converters located on the circuit pack. The backplane power feeders supply A and B –48 volts to these converters via diode ORed circuits and fuses mounted on the circuit pack. One converter supplies +5 volts and one supplies –5.2 volts for the circuit pack.

The 23G/23G-U and 23H/23H-U OLIU circuit packs are powered by four DC-to-DC converters located on the circuit packs. The backplane power feeders supply A and B –48 volts to these converters via diode ORed circuits and fuses mounted on the circuit packs. One converter supplies +5 volts, one supplies –5.2 volts, one supplies –2.3 volts, and one supplies +15 volts for the circuit packs.

TSI, TGS/TG3, 3DS3, and 3STS1E Circuit Packs

The BCP3 TSI, BBF2B/BBF4 TGS/TG3, 3DS3, and 3STS1E circuit packs are powered by a –48 volt to +5 volt DC-to-DC converter mounted on each circuit pack. The backplane power feeders supply A and B –48 volts to this converter via diode ORed circuits and fuses mounted on the circuit pack. The converter provides +5 volts DC power for TSI, TGS/TG3, 3DS3 and 3STS1E circuit packs.

Control Circuit Packs

The SYSCTL and OHCTL circuit packs are each powered by a –48 volt to +5 volt DC-to-DC converter located on the pack. The backplane power feeders supply A and B –48 volts to these converters via diode ORed circuits and fuses mounted on the circuit packs.

LEDs

Two green power on (PWR ON A and PWR ON B) LEDs on the Group 4 shelf user panel indicates that the shelf is receiving fused –48 volt power. The LEDs will remain illuminated as long as either –48 volt feeder is supplying power to the shelf.

Normally the FAULT LED on the circuit pack faceplates is operated via the controller which provides a ground return for current generated by the on-board converter. In the event of a DC-to-DC converter failure, the LED will be operated via the –48 volt power leads. The –48 volt power leads are supplied through an electronic gate or relay contact normally held open by the converter. The power, fusing, and LED circuits shown in Figure 4-2 are used on all circuit packs with on-board DC-to-DC converters.

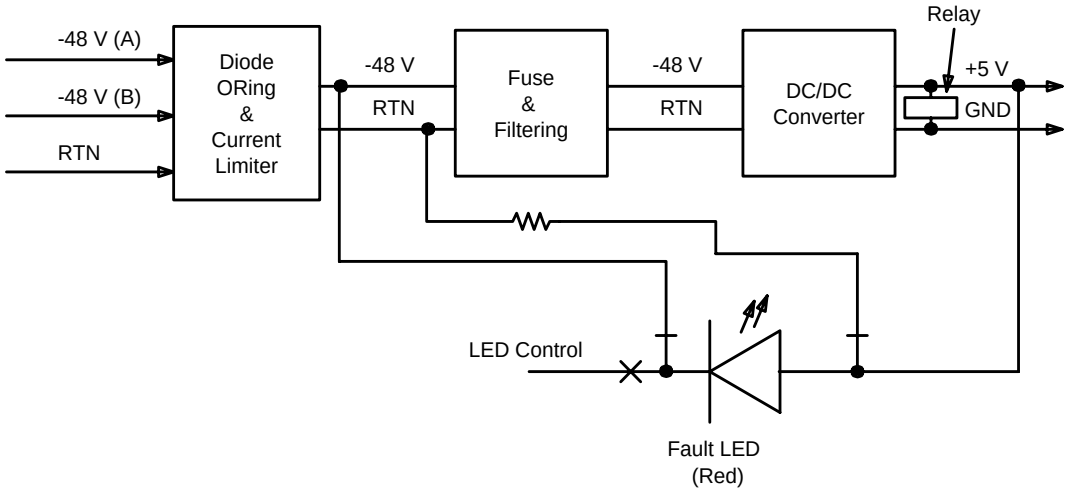


Figure 4-2. Circuit Pack Power and LED Control

Power Minor Alarm

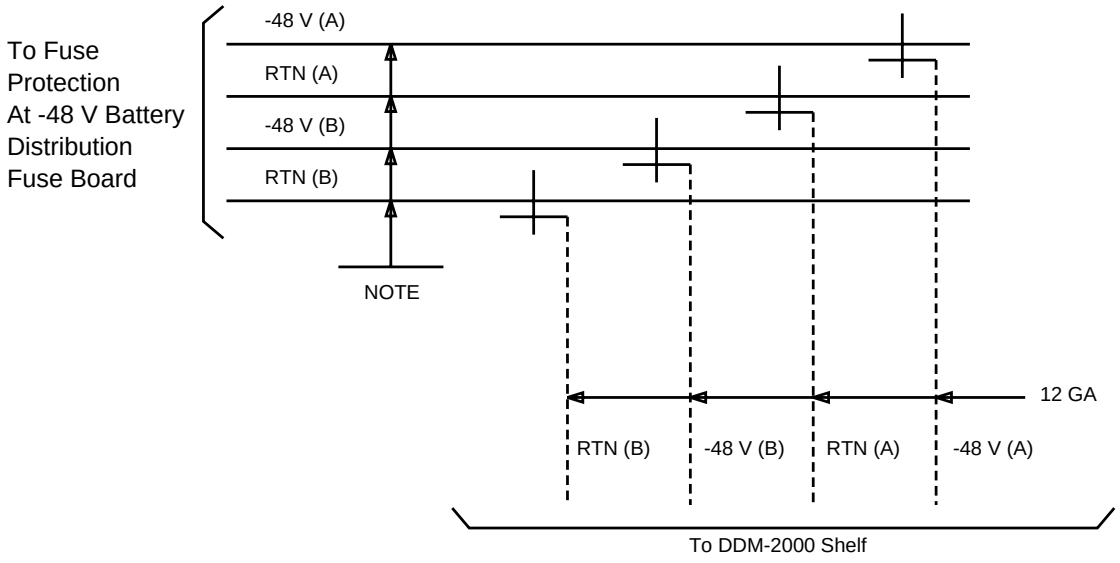
A yellow power minor (PMN) alarm LED is provided on the user panel to indicate an AC power failure at the remote terminal. The PMN alarm can be provisioned by a switch on the SYSCTL circuit pack at the central office (CO) to be either an office minor (MN) or office major (MJ) alarm.

Power Distribution

See "Power Requirements" in Section 10, "Technical Specifications," for power dissipation values.

Figure 4-3 shows a typical battery feeder interface for a single shelf.

CAUTION:
This information is for a typical application only. Consult 801-525-168, DDM-2000 Floor Plan Data Sheets, and T-82046-30, Power Systems DC Distribution Circuit for Digital Transmission System, for proper engineering of battery plant and feeders.



NOTE: Feeder size is selected per T82046-30 and EIM 90MV001, Issue 5.

Figure 4-3. Typical –48 Volt Power Supply for DDM-2000 OC-12 Single Shelf

Transmission and Synchronization Interfaces

5

Table of Contents

Overview 5-1

Transmission Interfaces 5-1

- OC-12 STS-1 Path Switched Ring 5-2
- Dual Ring Interworking (DRI) 5-4
- OC-3/OC-12 Ring (0x1) Low-Speed Interfaces 5-4
- Linear (1+1) Optical Extension Between OC-12 and OC-3 5-8

Synchronization Interfaces 5-10

- Free-Running 5-10
- Line Timing 5-10
- DS1 External 5-10
  - Holdover 5-11
- DS1 Output Modes: MULT and SYNC OUT 5-11
  - DS1 Output Mode, MULT 5-11
  - DS1 Output Mode, SYNC OUT 5-12
- Synchronization Messaging 5-16
  - Applications 5-16
  - DS1 Timing Output Integrity 5-17
  - Automatic Synchronization Reconfiguration 5-19
  - Synchronization Provisioning Integrity 5-21
  - Feature Details and Options 5-21
  - Examples 5-24
- Network Timing Distribution 5-30
  - Interoffice Timing Distribution 5-30
  - Access Network Timing Distribution 5-32

Table of Contents

Transmission and Synchronization Interfaces

5

Overview

This section describes the DDM-2000 OC-12 Multiplexer transmission and synchronization interfaces.

Transmission Interfaces

The DDM-2000 OC-12 Multiplexer supports DS3, OC-3, EC-1, and OC-3c low-speed interfaces and an OC-12 high-speed interface at both 1310 nm and 1550 nm wavelengths. The DDM-2000 OC-12 Multiplexer provides four low-speed function units (FN). Each can be equipped with:

- BBG11/BBG11B 3DS3 circuit packs (1x1 protected)
- BBG12 3STS1E circuit packs (1x1 protected)
- 21D/21D-U OLIU circuit packs (1+1 or 0x1 protected or STS-3c broadcast video)
- 21G/21G-U/21G2-U OLIU circuit packs (1+1 or 0x1 protected or STS-3c broadcast video).

The 3DS3, 3STS1E, 21D/21D-U OLIU, and 21G/21G-U/21G2-U OLIU circuit packs can be mixed in any combination across the four function units to provide for termination/transport of 12 STS-1 signals or 4 concatenated STS-3c (OC-3c) signals. The DS3 interfaces accept any DSX-3 compatible clear channel signal.

Table 5-1 summarizes the DDM-2000 OC-12 Multiplexer transmission interfaces for the current software release.

Table 5-1. DDM-2000 OC-12 Multiplexer Application Summary Matrix

Application	Ring (R7.0)
DS1 Low-speed *	X
DS3 Low-speed	X
EC-1 Low-speed	X
OC-12 High-speed	X
OC-3 Low-speed	X
OC-3c Low-speed	X
IS-3 Low-speed	X
IS-3c Low-speed	X

* Requires OC-3 shelf in addition to OC-12 shelf.

OC-12 STS-1 Path Switched Ring

Figure 5-1 is an overall block diagram of a DDM-2000 OC-12 Multiplexer STS-1/VT1.5 path switched ring node. The DDM-2000 OC-12 Multiplexer ring supports DS3 and EC-1 low-speed interfaces in an STS-1 path switched ring configuration, 0x1 OC-3/IS-3 interfaces in an STS-1/VT1.5 path switched ring configuration, and optical extensions with OC-3/IS-3 or OC-3c/IS-3c interfaces. The time slot interchange (TSI) feature provides full flexibility in assigning signals between low-speed DS3, OC-3/OC-3c/IS-3/IS-3c, and EC-1 ports and the high-speed interface. Each function unit can handle a maximum of 3 STS-1s for a total of 12 STS-1s or one STS-3c for a total of 4 STS-3cs.

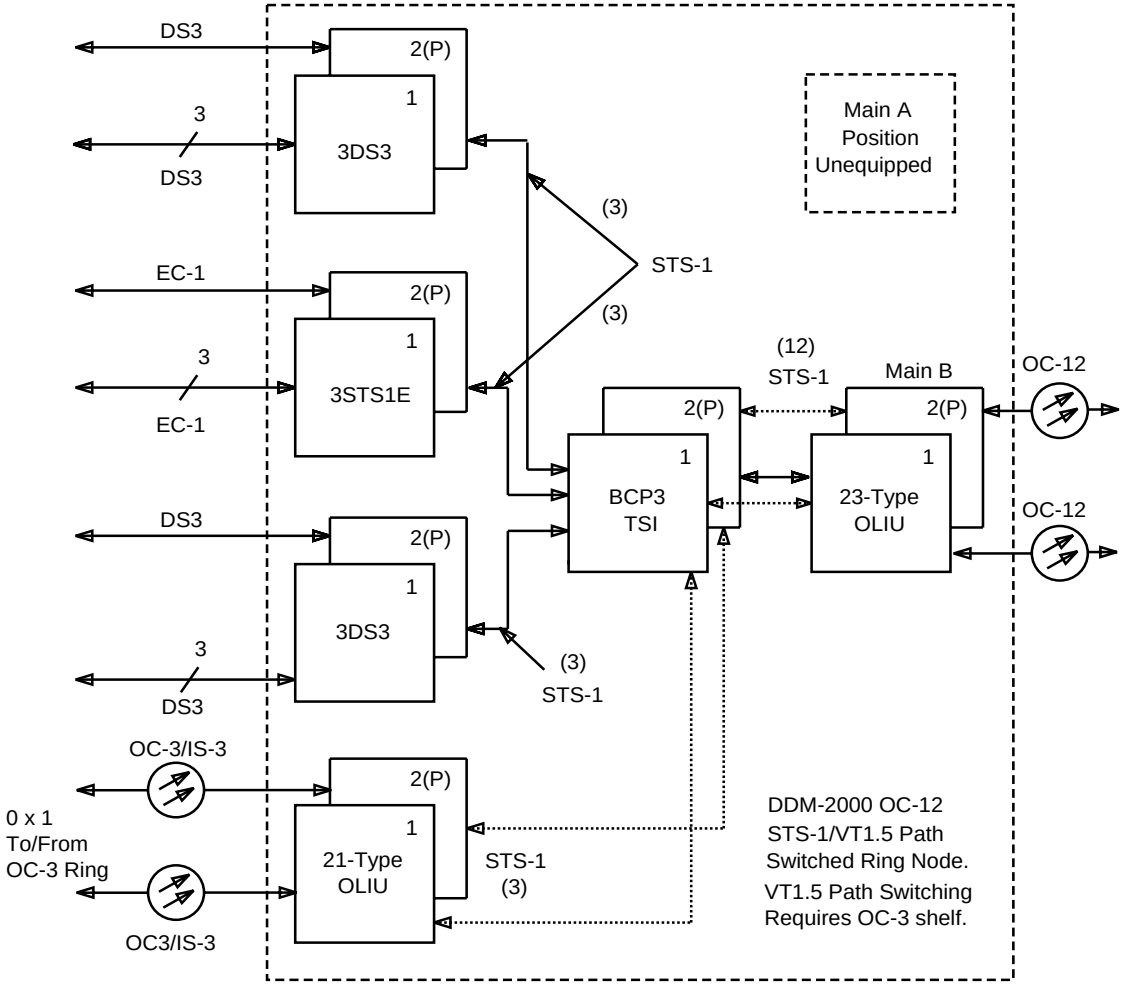


Figure 5-1. OC-12 Multiplexer Block Diagram — STS-1/VT1.5 Path Switched Ring Node

Dual Ring Interworking (DRI)

The DDM-2000 OC-12 Multiplexer STS-1/STS-3c DRI application uses the same shelf configuration as the DDM-2000 OC-12 Multiplexer path switched ring (Figure 5-1). In this configuration, the DDM-2000 OC-12 Multiplexer can provide STS-1 DRI with another DDM-2000 OC-12 ring, a DDM-2000 OC-3 ring, or an FT-2000 OC-48 Lightwave System ring with redundant signal appearances at the two central offices via EC-1/OC-3/OC-3c/IS-3/IS-3c and DS3 interfaces (see Figure 9-8 in Section 9 "Maintenance Description"). STS-1 paths are provisioned for drop and continue at the interconnecting nodes, and path selection is at the STS-1 level. When used with the DDM-2000 OC-3 Multiplexer, the DDM-2000 OC-12 Multiplexer STS-1/VT1.5 (0x1) DRI application can be created with the drop and continue feature implemented in the DDM-2000 OC- 3 Multiplexer shelf. The DDM-2000 path switched ring architecture allows mixing of drop and continue circuits with standard path switched circuits.

OC-3/OC-12 Ring (0x1) Low-Speed Interfaces

The DDM-2000 OC-12 ring supports (0x1) OC-3/IS-3 interfaces in its function unit slots. These interfaces must be provisioned as 0x1 and are supported in single homing and dual homing configurations (see Figure 5-2 and Figure 5-3 respectively). For single homing, signals pass through the DDM-2000 OC-12 transport ring and exit to the DDM-2000 OC-3 ring. OC-12 function unit slot FN(x)-1 is connected to OC-3 main-1 and OC-12 FN slot FN(x)-2 is connected to OC-3 main-2. Switching is not done on the DDM- 2000 OC-12 Multiplexer on these lines, or paths on these lines; rather VT1.5 or STS-1 level path switching is done on the DDM-2000 OC-3 Multiplexer. This allows DDM-2000 OC-3 nodes running ring software to interface with DDM-2000 nodes of an OC-12 ring in such a way as to provide ring-on-ring architecture. Each OC-3 ring so supported occupies up to three STS-1 time slots on the OC-12 ring. Each OC-12 node can provision the same STS-1 time slots as other OC-12 nodes to drop to the OC-3 shelf (to share STS-1s among several OC-3 shelves), or the OC-12 node can provision different STS-1s at different sites. The OC-12 ring passes the contents of these STS-1 time slots between the low-speed OC-3/IS-3 lines and OC-12 high-speed lines without terminating them or performing any path protection switching on them. Up to four OC-3 rings can be supported in this fashion by an OC-12 ring to maximize the OC-12 bandwidth utilization. This allows access to any and all VT1.5 signals at an OC-12 site.

The OC-3/IS-3 lines between an OC-12 node and an OC-3 node connected in a ring (0x1) fashion behave like the OC-3 lines between the nodes on an OC-3 ring and do not perform line level protection switching. Instead, the OC-3 shelves perform the normal path protection switching functions.

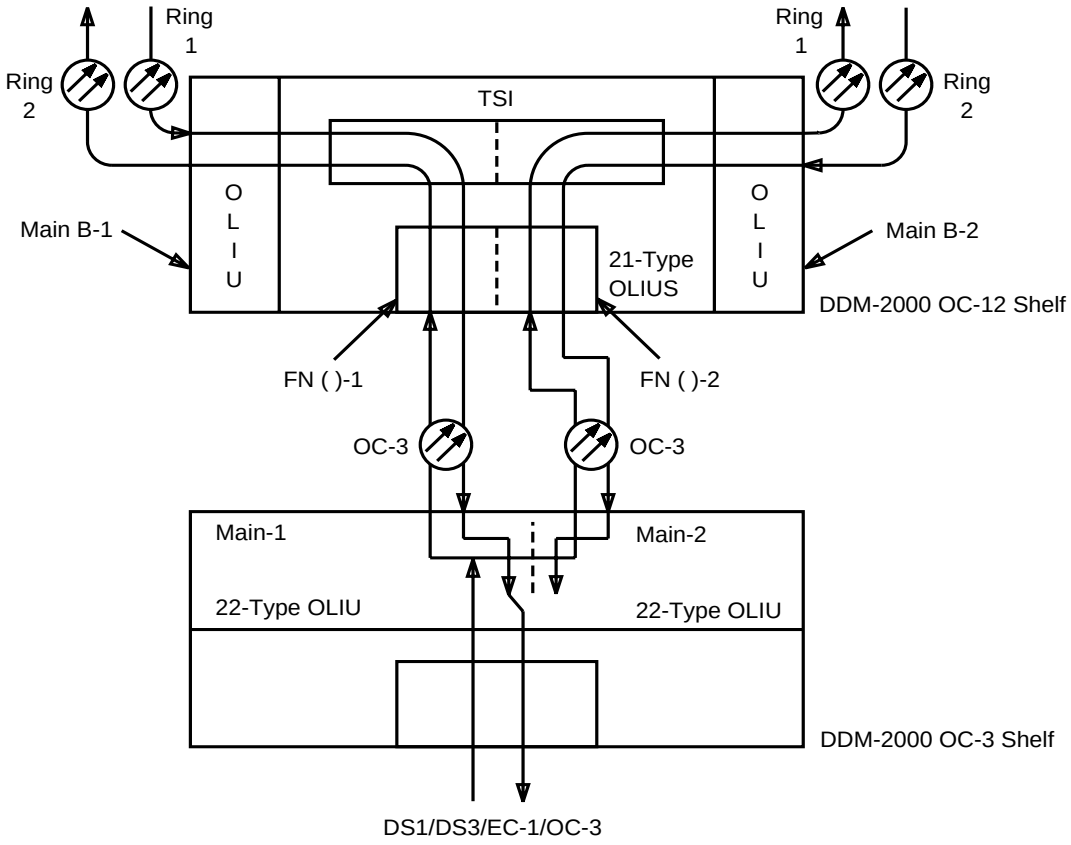


Figure 5-2. OC-3/OC-12 Ring (0x1) Low-Speed Interfaces — Single Homing

See Figure 5-3. For dual homed 0x1 ring applications, one function unit slot on the OC-12 shelf must be empty. When the OC-12 shelf is provisioned for 0x1 (default) operation, incoming Ring 1 (incoming to main B-1) always feeds (is locked to) function unit ( )-1 and, therefore, main-1 of the OC-3 shelf. Similarly, incoming Ring 2 (incoming to main B-2) always feeds (is locked to) Function Unit ( )-2 and, therefore, main-2 of the OC-3 shelf.

Similarly, the TSI on the OC-12 shelf are locked so that Ring 1 output is always fed from function unit ( )-2, and Ring 2 output is always fed from function unit ( )-1. The Ring 1 input is always received on main B-1, and the Ring 2 input is always received on main B-2.

When STS-1s are dropped to a 0x1 function unit, any fiber failure detected at either the OC-3 shelf or OC-12 shelf will cause the OC-3 shelf to select all traffic from the other ring.

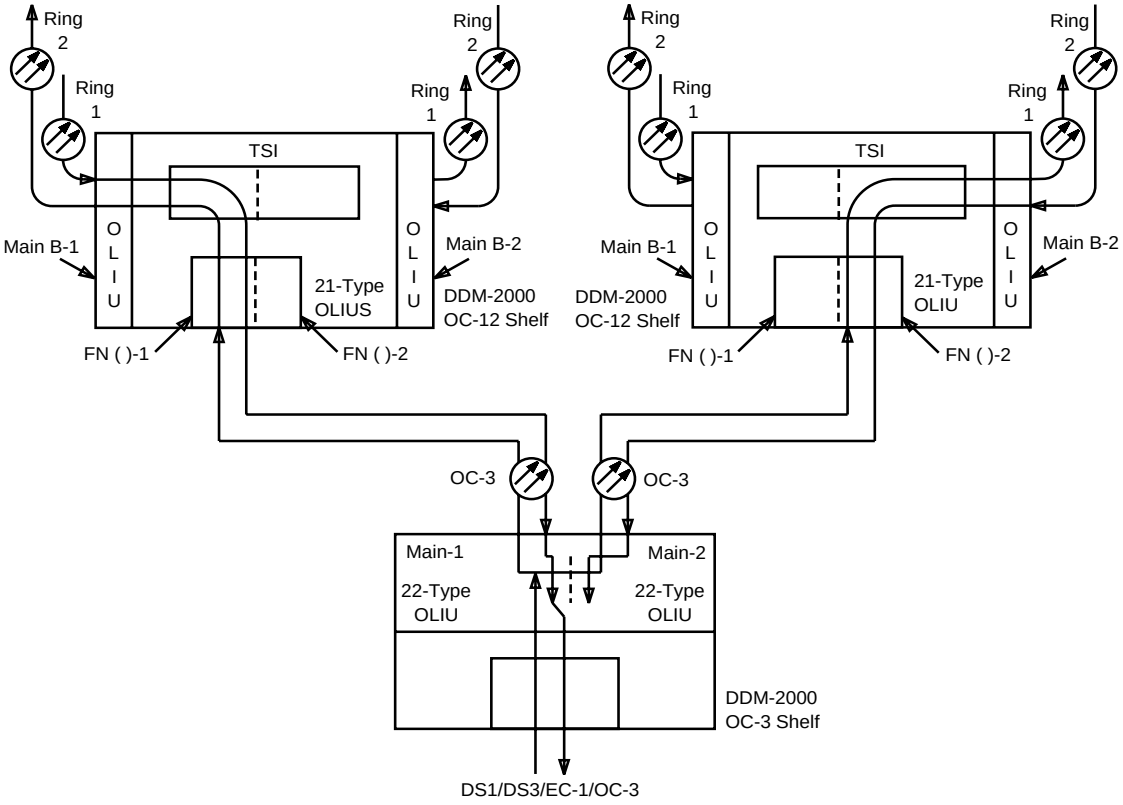


Figure 5-3. OC-3/OC-12 Ring Low-Speed Interfaces (0x1) — Dual Homing

Linear (1+1) Optical Extension Between OC-12 and OC-3

See Figure 5-4 and Figure 5-5. The function units in the DDM-2000 OC-12 shelf can contain linear (1+1) protected OC-3/IS-3 circuit packs. This allows a DDM-2000 OC-12 shelf to connect to the main slots of a DDM-2000 OC-3 shelf. This allows more options in designing a DDM-2000 network, such as adding a DDM-2000 OC-3 shelf off of a DDM-2000 OC-12 ring. In the transmit direction, a circuit pack failure will cause a switch. In the receive direction, an incoming STS signal failure or circuit pack failure will cause a switch.

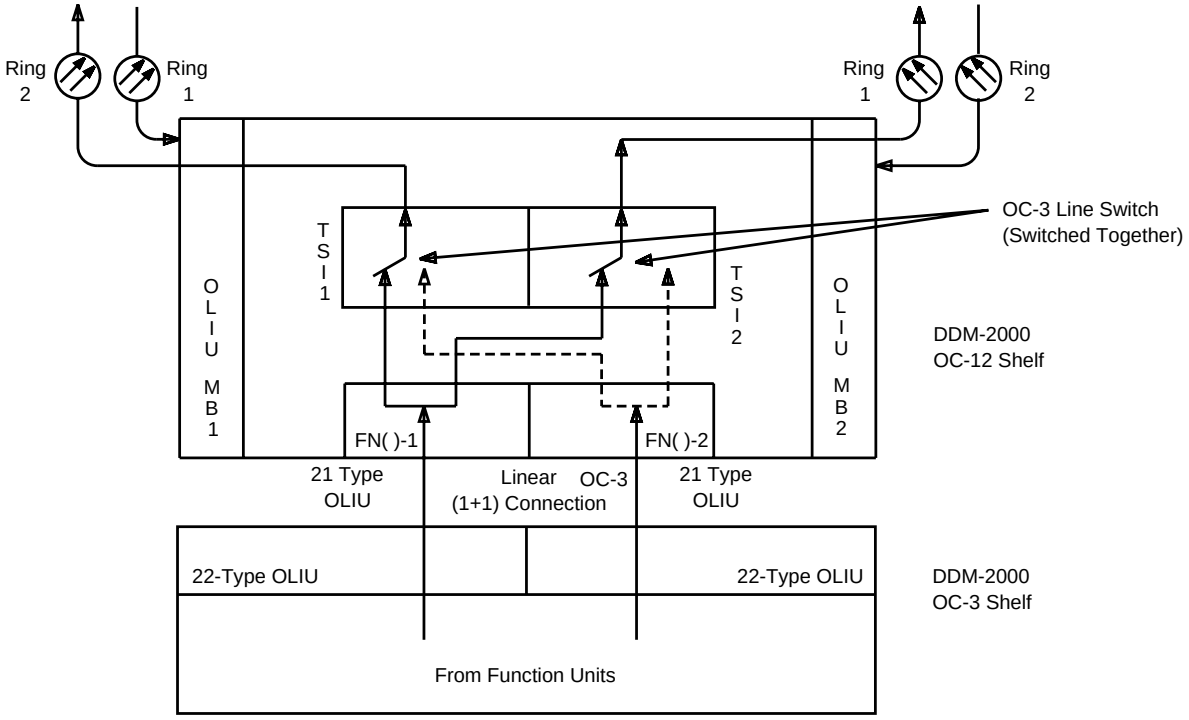


Figure 5-4. OC-12 Ring Shelf with Linear (1+1) OC-3 Low-Speed Interfaces (Transmit)

Note that for OC-12 OLIU or incoming STS-1 path failure, the STS path switch takes place in the TSI. For TSI circuit pack failure, the switch occurs in the function unit OLIUs.

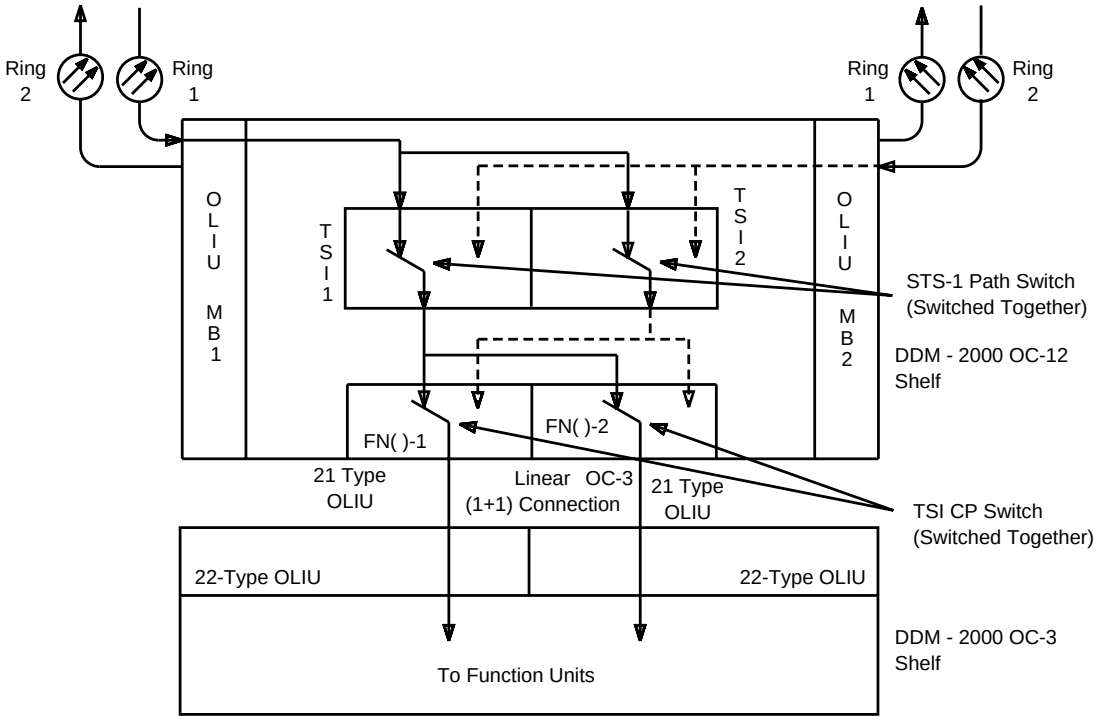


Figure 5-5. OC-12 Ring Shelf with Linear (1+1) OC-3 Low-Speed Interfaces (Receive)

Synchronization Interfaces

Each DDM-2000 OC-12 Multiplexer can be provisioned to one of three timing modes:

- Free-running from an internal oscillator
- Line timing from an incoming optical interface. This timing reference is used to generate all outgoing signals. Line timing is an intermediate node that derives timing from the incoming fiber. Loop timing is a special case of line-timing and is the terminating node that derives timing from the incoming fiber.
- External timing from the digital synchronization network via DS1 references (DS1 External).

The terms loop timing and line-timing have been changed to clarify timing terminology. When the OLIU derives local shelf timing from the incoming optical signal and the shelf is an intermediate shelf (choice of OC-N lines for timing) in a linear network for example, it is called line-timing. Loop timing is a subset of line-timing used to describe the timing mode of the terminating node (single source of timing) of a linear network, for example.

NOTE:
The synchronization and timing examples used throughout this chapter reference the timing generators as “TG.” This could represent either the BBF2B TGS or the stratum 3 BBF4 TG3.

Free-Running

For free-running operation, the TG derives timing from a temperature-compensated, voltage-controlled crystal oscillator (TCVCXO) and a digital phase-locked loop (DPLL) with a full temperature range end-of-life accuracy of ±15 parts-per-million (ppm) for the BBF2B TGS, and ±4.6 ppm for the BBF4 TG3.

Line Timing

The reference signal feeding the phase-locked loop (PLL) is selected from the internal oscillator or a line-timing clock derived from the incoming optical line. In line-timing mode, the OC-12 line being selected for transmission is also selected as the timing reference.

DS1 External

Each TG circuit pack receives one DS1 reference signal which it monitors and from which it recovers a clock signal. The recovered clock is cross-fed to its companion TG circuit pack in the same shelf. If the microprocessor on one TG circuit pack detects an incoming DS1 reference failure, it will signal the microprocessor on the companion TG circuit pack.

Thus, each TG circuit pack has two DS1 references to choose from, one which is input directly and the other cross-fed. Both TG circuit packs will normally select the same DS1 input. A loss of both DS1 references results in the TG circuit pack entering holdover mode.

Holdover

The TG circuit pack has an internal TCVCXO that maintains shelf timing within ± 4.6 ppm (BBF2B TGS) or ± 0.37 ppm (BBF4 TG3) for 24 hours in the event of an unprotected timing DS1 reference failure.

DS1 Output Modes: MULT and SYNC OUT

The DDM-2000 supports two DS1 output modes: MULT and SYNC OUT. Both modes are used in conjunction with external synchronization modes but only one may be supported on a single shelf.

DS1 Output Mode, MULT

In a CO environment where multiple DDM-2000 Multiplexers are installed in a network bay frame, a single pair of DS1 timing references from the building integrated timing supply (BITS) can be used to externally synchronize all shelves in a bay. This unique feature reduces the number of BITS output ports required to externally synchronize multiple DDM-2000s, thus minimizing network costs.

Each DDM-2000 provides two sets of DS1 input and output ports, one set per TG circuit pack. A DS1 timing reference is initially connected to the bottom shelf in the bay (shelf 1) and each TG terminates and actively buffers this timing reference. The reference is then used as a synchronization reference for that shelf. The buffered signal is also output from each TG as a DSX level (with adjustable equalization). (The TG does not retime or influence the DS1 output when in the holdover mode.) This DS1 output is then connected to the DS1 input port of the next DDM-2000 in the bay via a special (MULT) cable forming a MULT chain. See 363-206-200, *DDM-2000 Multiplexer Applications, Planning, and Ordering Guide*, for cabling information.

If a TG in the MULT chain is removed, shorting contacts in the backplane will redirect input and output signals so the subsequent shelves continue to receive valid DS1 signals. However, if a BBF2B/BBF4 provisioned for SYNC OUT is inserted in the MULT chain, the traceability of the DS1 output will be affected. This could result in untraceable timing or the creation of timing loops. To ensure that replacement circuit packs are provisioned correctly, the DDM-2000 software will monitor newly inserted packs for the correct “shelf provisioning.” If a newly inserted pack does not match the shelf provisioning, the fault LED is lit on that pack and indicates that a provisioning error has occurred. It is always best to verify TG provisioning **before** insertion.

DS1 Output Mode, SYNC OUT

In a CO environment, it may be necessary to externally synchronize a BITS to a SONET reference with traceability to a primary reference source (PRS). When optioned for SYNC OUT the DDM-2000 will output a derived DS1 traceable to a selected OC-12 input. The frequency of the optical line is divided down to a 1.544 MHz signal and used to create the derived DS1.

When using SYNC OUT, two input timing modes are available: DS1 external-timing or line-timing. These timing modes will only influence the synchronization source used for the derived DS1. In SYNC OUT mode the DDM-2000 uses an external DS1 reference for synchronization This external reference typically comes from a BITS. In line-timing SYNC OUT mode, the DDM-2000 will use a selected optical reference for synchronization. The derived DS1 is carried to the BITS by a special SYNC OUT cable which is capable of externally timing the DDM-2000 if the DS1 external SYNC OUT mode is selected. See 363-206-200, *DDM-2000 Multiplexer Applications, Planning, and Ordering Guide*, for cabling information.

If a TG provisioned for MULT is inserted into a DDM-2000 provisioned for SYNC OUT the traceability of the DS1 output will be altered. This could result in untraceable timing or the creation of timing loops. To ensure that replacement packs are provisioned correctly, the DDM-2000 software monitors newly inserted packs for the correct “shelf provisioning.” If a newly inserted pack does not match the shelf provisioning, the fault LED is lit on that pack and indicates that a provisioning error has occurred. It is always best to verify TG provisioning **before** insertion.

The free-running, line-timing, and DS1 external timing modes can be combined into various subnetwork configurations, some of which are shown in Figure 5-6. The figures show basic single span configurations. In more complex subnetworks such as hubbing, these basic span configurations are duplicated and/or mixed, depending on the application, to produce a subnetwork synchronization configuration.

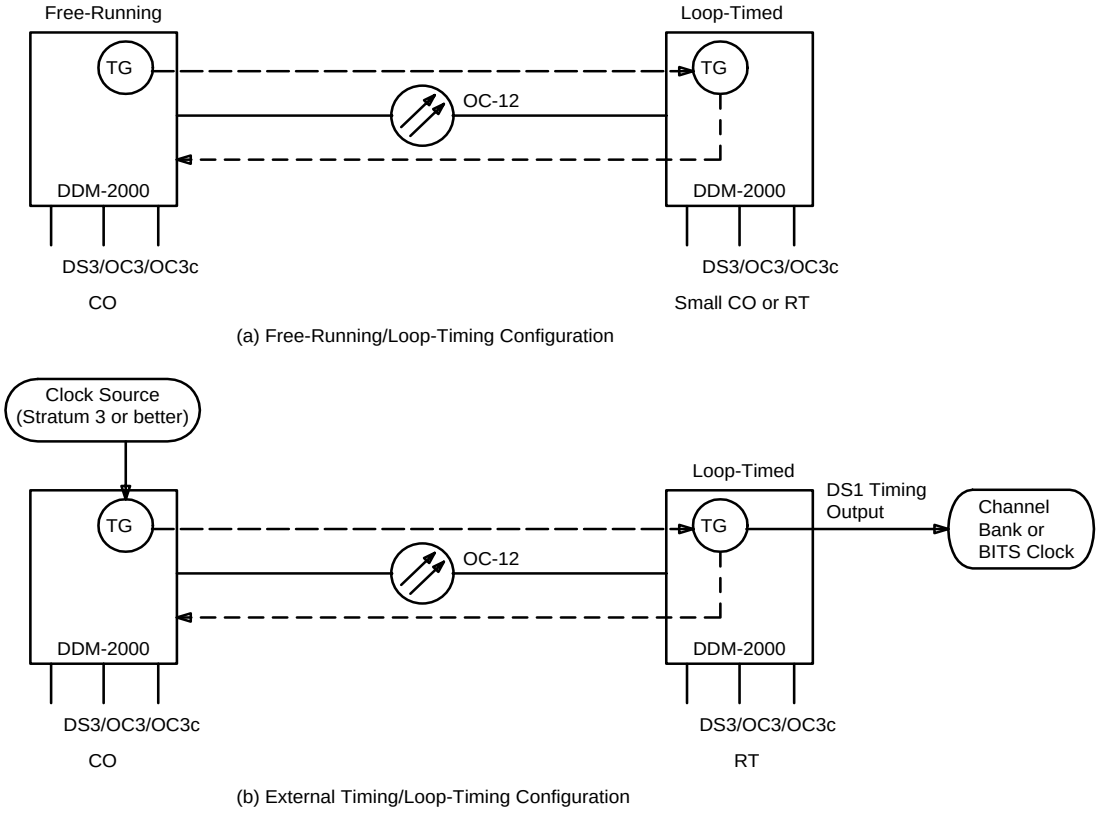


Figure 5-6. Synchronization Timing Configurations (Sheet 1 of 2)

Figure 5-6a shows the CO system is internally timed (free-running). At the remote terminal (RT), the TG derives its timing from the incoming optical signal and uses it to time itself and loop timing back to the CO.

Figure 5-6b and Figure 5-6c show the CO timed from an external stratum 3 or better source. The RT derives its timing from the incoming optical line and can send a DS1 output to a BITS clock.

The external timing configuration (Figure 5-6d) uses external DS1 timing to each DDM-2000 Multiplexer in the network. Since this configuration requires local office clocks at each site, it is most suited to interoffice applications. A DDM-2000 network may have all DS1 references traceable to a primary reference source (synchronous operation) or multiple primary reference sources (plesiochronous operation).

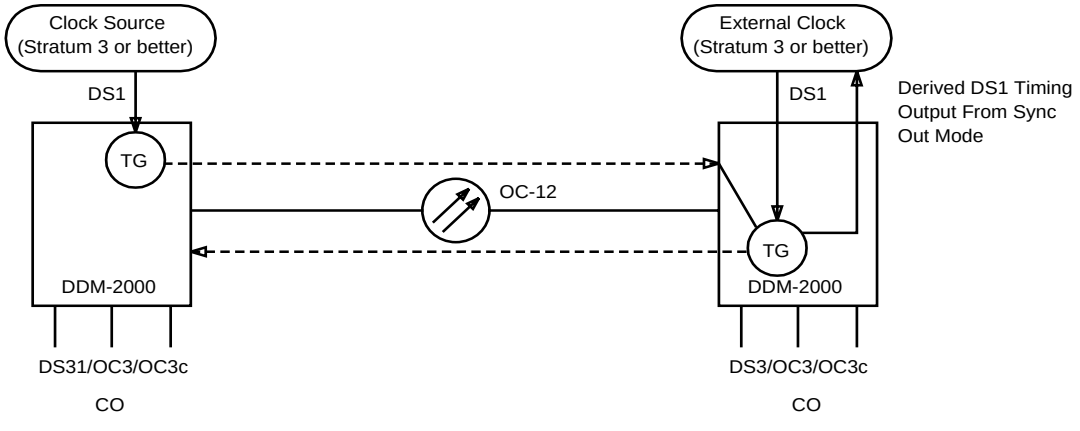
The PRS is equipment that provides a timing signal whose long-term accuracy is maintained at 10^{-11} or better with verification to universal coordinated time (time and frequency standard maintained by the U. S. National Institute of Standards and Technology), and whose timing signal is used as the basis of reference for the control of other clocks in a network.

An interoffice ring should have each node externally timed if BITS clocks are available. All other rings should have one node externally timed (two in some dual homing configurations) and the rest of the nodes line timed. See 363-206-200, *DDM-2000 Multiplexer Applications, Planning, and Ordering Guide*, for more synchronization information.

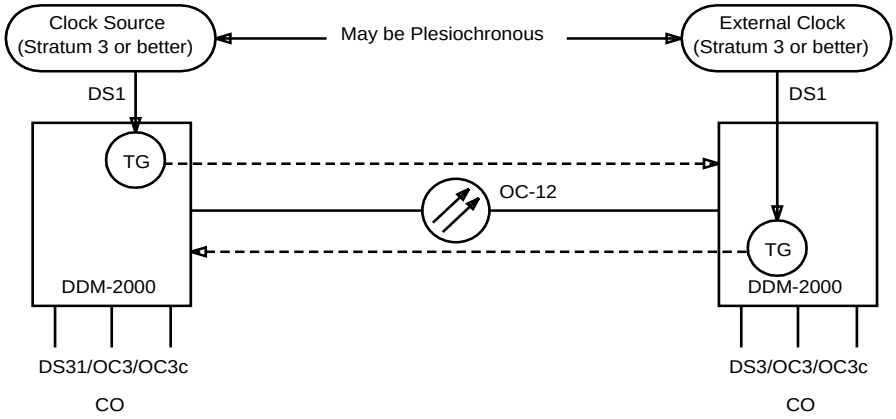
Table 5-2 summarizes the DDM-2000 OC-12 synchronization modes for the current software release.

Table 5-2. DDM-2000 OC-12 Multiplexer Synchronization

Application	Ring (R7.0)
Free-Running	X
Line-Timing	X
External Timing	X
DS1 Sync Output	X
Synchronization Messaging	X
Automatic Synchronization Reconfiguration	X



(c) External Timing Configuration



(d) External Timing Plesiochronous (BBF2B)

Figure 5-6. Synchronization Timing Configurations (Sheet 2 of 2)

Synchronization Messaging

SONET synchronization messaging is used to communicate the quality of subnetwork timing, internal timing status, and timing states throughout a subnetwork. Transitions to and from holdover or between OC-12 references, for shelf timing, and to and from DS1 AIS, for the DS1 output, are based on synchronization messages received over the OC-12 line from which the DDM-2000 system is extracting timing. In ring networks with synchronization messaging, either TG circuit pack allows line-timing and automatic switching from either of the two ring optical interfaces.

The DDM-2000 Multiplexers provide a synchronization messaging feature to ensure the integrity of network synchronization during both normal and abnormal conditions. Through the use of synchronization messaging, the current quality of the timing source can be conveyed from one DDM-2000 Multiplexer to the next. This capability allows the DDM-2000 Multiplexers to automatically change their timing reference in order to always maintain the highest quality timing available. The capability also allows the DDM-2000 Multiplexers to inform a local BITS clock when the DS1 timing output has been degraded and should no longer be used as a reference. This synchronization messaging feature is based on the scheme developed in the American National Standards Institute (ANSI) T1X1 standards committee.

Applications

The applications that are currently supported with the synchronization messaging feature can be divided into three categories:

1. DS1 Timing Output Integrity
2. Automatic Synchronization Reconfiguration
3. Synchronization Provisioning Integrity.

DS1 Timing Output Integrity

The DS1 timing outputs are typically used to distribute timing from the BITS clock in one office (master) to the BITS clock in the next office (slave), using the SONET transmission facilities between them as the synchronization vehicle. The BITS are typically of stratum 2 or stratum 3 accuracy. The DDM-2000 Multiplexer does not introduce its own internal timing source onto the SONET facility but merely transfers the quality of its timing reference. This ability preserves the required hierarchical structure of the timing network and should be maintained at all times.

If the DDM-2000 Multiplexer at the master office enters holdover due to a disconnected reference cable or a local BITS failure, the quality of the DS1 timing output at the slave office will now be traceable directly to the DDM-2000 Multiplexer. If the master DDM-2000 system contains a TG3 circuit pack, stratum 3 accuracy will be maintained indefinitely. This provides acceptable timing for stratum 3 NEs at slave offices. If the master DDM-2000 contains a TGS circuit pack, stratum 3 accuracy will be maintained for the first 24 hours of holdover. After the first 24 hours, the DDM-2000 system could exceed stratum 3 accuracy.

If a DDM-2000 system contains a TGS pack, it may change the output of its derived DS1 under some conditions. If the incoming synchronization message is better than internal clock (IC) the derived DS1 will be an ‘all ones’ with framing. This format is suitable for providing synchronization to a BITS of stratum 3 accuracy. If the co-located DDM-2000 enters holdover or the incoming synchronization message is IC or worse, the derived DS1 format will change to ‘all ones’ without framing (AIS). This will prevent a BITS from using this input and force the BITS to either select a new input or enter holdover. This change to AIS preserves the stratum timing hierarchy by allowing the BITS to synchronize from a clock of equal or higher quality.

Available in R5.1 and later is the threshold AIS feature. This feature allows the user to select the value of the incoming message that causes the derived DS1 output to output AIS. This feature will allow stratum 2 BITS clock to receive timing from a TGS or TG3 without violating stratum timing rules.

As shown in Figure 5-7a (Figure 5-7 is an OC-3 linear application used to explain the concepts of synchronization messaging.), SONET synchronization messaging notifies the DDM-2000 Multiplexer at the slave site to place alarm indication signal (AIS) on the DS1 timing output. This BITS can then enter holdover or switch to an alternate reference.

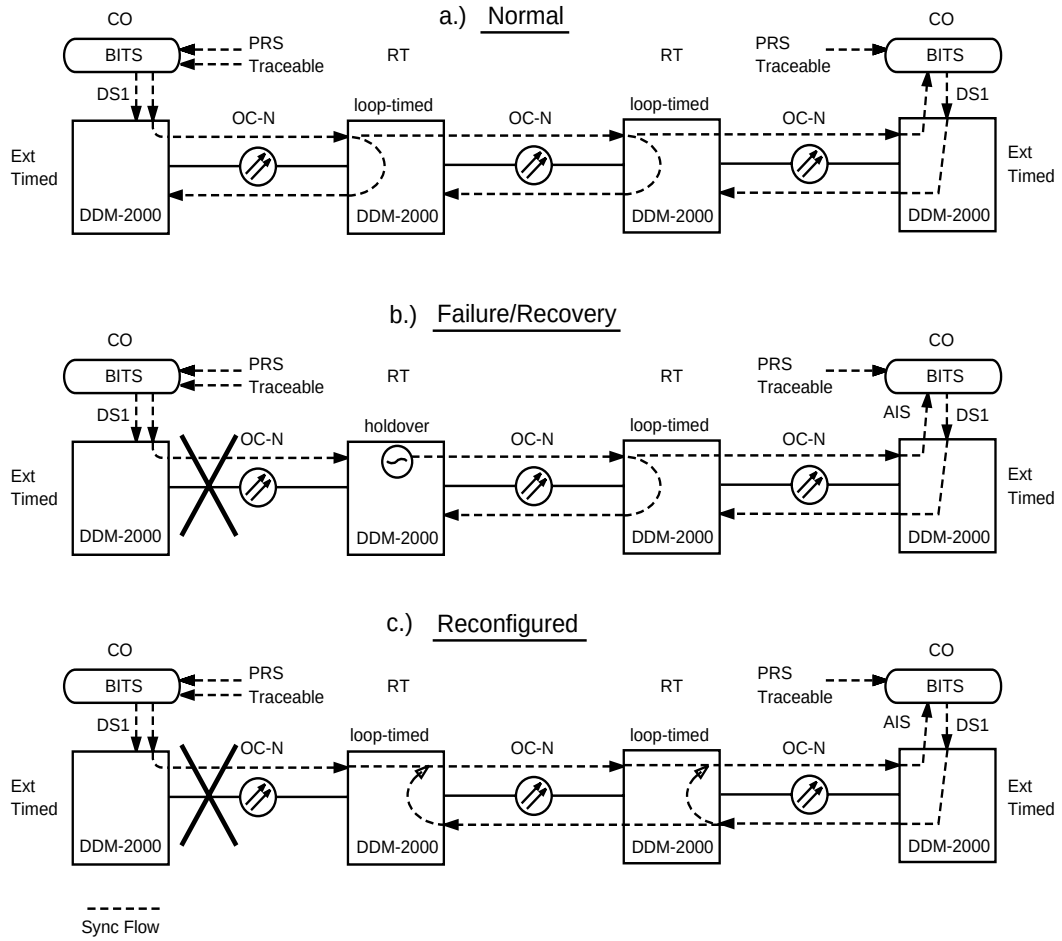


Figure 5-7. DS1 Timing Output — Dual Homing Linear

Automatic Synchronization Reconfiguration

SONET was designed to operate optimally in a synchronous environment. Although plesiochronous and asynchronous operation can be supported through the use of pointer adjustments, transmission quality is affected by the generation of additional jitter and wander due to pointer adjustments. Because of this, it is desirable to maintain synchronous operation whenever possible.

Through the use of synchronization messages, the quality of the different timing references can be made available at each DDM-2000 Multiplexer. The DDM-2000 OC-12 Multiplexer shelf can always determine the best timing reference available to it and switch to it. Through this mechanism, the synchronous operation of the subnetwork can be maintained. The switching of timing references is hitless, and the synchronization messages also allow it to be done without creating timing loops in the process. Note that automatic synchronization reconfiguration applies only to switching between available and line-timing references and not between timing modes. For example, switching between line-timed to external timed or external timed to line-timed would not be supported.

In the linear dual-homing network in Figure 5-7, normal operation includes an external timing reference at each of the COs. The RT sites are each loop timed from the CO DDM-2000 Multiplexers on the left. If a fiber failure occurs between the first two DDM-2000 Multiplexers, the automatic synchronization reconfiguration feature will cause the loop timed DDM-2000 Multiplexers to change their direction of loop timing. This prevents any DDM-2000 Multiplexer from operating in holdover for an extended period of time.

Consider the access ring network in Figure 5-8. Under normal operation, the ring has one DDM-2000 Multiplexer externally timed and the others line-timed in the counterclockwise direction. If a fiber failure occurs between the first two DDM-2000 Multiplexers, the automatic synchronization reconfiguration feature will cause the DDM-2000 Multiplexers to change their line-timed directions to clockwise. The result is that the ring is again operating synchronously. The ring already provides self-healing restoration of the traffic, so it is especially important to maintain synchronous operation during this type of failure to prevent service degradation due to increased jitter and wander.

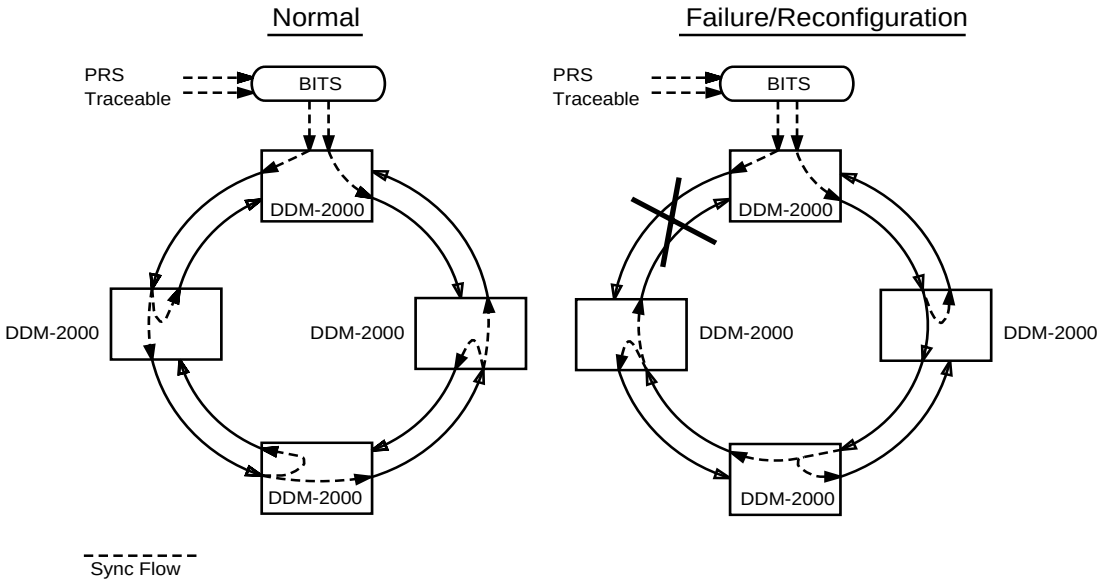


Figure 5-8. Synchronization Reconfiguration — Access Ring

Synchronization Provisioning Integrity

A welcome side feature of synchronization messaging is that it helps prevent provisioning errors. Provisioned timing loops on the DDM-2000 Multiplexers will be quickly detected through the synchronization messaging algorithm and prevented by forcing a shelf into holdover. The system can then be reprovisioned correctly.

Feature Details and Options

As mentioned previously, SONET synchronization messaging is used to communicate the quality of the subnetwork timing throughout the subnetwork. This is done using bits 1-3 of the K2 byte found in the SONET overhead. In OC-12 Release 5.1 and later releases, synchronization messaging can also be done using bits 5-8 of the S1 byte in the SONET overhead. If a DDM-2000 OC-12 system is deriving timing from a given OC-N interface, and synchronization messaging is enabled on that interface (Kbyte messages and Sbyte messages in OC-12 Release 5.1 and later are provisioned using the **`set-ocn`** command), the system interprets the received message to determine its internal timing status. The system also determines the state of the DS1 output, if the DS1 output is enabled. The DDM-2000 OC-12 system also transmits over the particular OC-N interface and all other OC-N interfaces that are enabled for synchronization messaging, the appropriate message indicating the quality of its timing and its active timing mode. Table 5-3 and Table 5-4 list the associated internal timing status and DS1 Output states that are associated with synchronization messages received from the OC-N interface when synchronization messaging is enabled. The tables lists the messages from low to high quality.

Table 5-3. Synchronization Messages using K2 Byte

Received Message	Active Timing Mode *	Default DS1 Output State	Quality Level
Don't Use	Holdover	AIS	7
Timing Looped Back (TLB)	Holdover	AIS	7
Stratum 4 †	Holdover	AIS	6
Internal Clock (IC)	OK to use	AIS	5
Internal Clock (IC) (w/TG3)	Holdover	AIS	5
Stratum 3 †‡	OK to use	Good	4
Stratum 2 †	OK to use	Good	3
Sync Quality Unknown (SQU)	OK to use	Good	2
Stratum 1 †	OK to use	Good	1

***** This column applies only when provisioned for line timing mode.

† Presently, DDM-2000 OC-12 Multiplexers cannot generate these messages, but they could be retransmitted and supported for autoreconfiguration if any of these are received by DDM-2000 OC-12 Multiplexer.

‡ The TG3 circuit pack can generate a stratum 3 message.

Table 5-4. **Synchronization Messages using S1 Byte ***

Received Message	Active Timing Mode †	Default DS1 Output State	Quality Level
Don't Use	Holdover	AIS	7
Traceable SONET minimum Clock	OK to use	AIS	5
Traceable SONET minimum Clock (w/TG3)	Holdover	AIS	5
Traceable Stratum 3 ‡§	OK to use	Good	4
Traceable Stratum 2 ‡	OK to use	Good	3
Sync Trace Unknown	OK to use	Good	2
PRS Traceable ‡	OK to use	Good	1

***** This table is applicable to OC-12 R5.1 and later releases.

† This column applies only when provisioned for line timing mode.

‡ Presently, DDM-2000 OC-12 Multiplexers cannot generate these messages, but they could be retransmitted and supported for autoreconfiguration if any of these are received by DDM-2000 OC-12 Multiplexer.

§ The TG3 circuit pack can generate a stratum 3 message.

Synchronization messaging using the SONET K2 byte and S1 byte can be disabled on a per OC-N interface using the **`set-ocn`** command (not supported by OC-1). Zeros will be transmitted on bits 1-3 of the K2 byte if this is done; all ones will be transmitted on bits 5-8 of the S1 byte if this is done. The timing and synchronization status of a shelf can be determined using the **`rtrv-sync`** command.

The "Don't Use" message is sent when the system determines that its timing is not suitable for synchronization; for example, due to failure.

When the DDM-2000 OC-12 system is configured for external timing and its DS1 output port is provisioned for MULT mode, the message Sync Quality Unknown (SQU) for K byte, or Sync Trace Unknown (STU) for S byte, is sent on all the OC-N interfaces where synchronization messaging is provisioned. When the capability of communicating with a BITS clock over the DS1 overhead exists, the quality of the reference signal will be transmitted instead; for example, Stratum 1.

When the DDM-2000 OC-12 system is configured for external timing and its DS1 output port is provisioned for SYNC OUT mode, the Timing Looped Back (TLB) message for K byte, or “Don’t Use” message for S byte, will be sent on the OC-N interfaces towards the network element (NE) from which the DS1 timing output is being derived. The SQU message for K byte, or STU for S byte, will be sent on all other OC-N interfaces where synchronization messaging is provisioned. If the DS1 output is generating AIS while the system is configured in this way, the

message SQU for K byte, or STU for S byte, will be transmitted on all OC-N interfaces.

When the DDM-2000 OC-12 system is configured for free-run or is in holdover mode, the Internal Clock message for K byte, or Traceable SONET minimum Clk for S byte, will be sent on all OC-N interfaces where synchronization messaging is provisioned.

When the DDM-2000 OC-12 system is configured for line timing, the TLB message for K byte, and “Don’t Use” for S byte, will be sent on the OC-N interfaces towards the NE from which the timing is being derived. The message received on the OC-N interface will be sent on all other OC-N interfaces where synchronization messaging is provisioned.

With automatic synchronization reconfiguration, the DDM-2000 Multiplexer systems use and compare the incoming synchronization messages on the OC-N interfaces available for line-timing to select the highest quality synchronization reference available. If the received quality levels are the same on the references available for timing, the existing line timing reference takes precedence. This feature guarantees the nonrevertive operation of reconfiguration. The line-timing reference is provisioned by the **`set-sync`** command. Table 5-3 lists the synchronization messages in ascending order.

The existence of automatic synchronization reconfiguration does not change the system's behavior on traditional line failures; for example, loss of frame (LOF), loss of signal (LOS), and others.

There are synchronization references in the DDM-2000 system that can be provisioned as network timing sources but are not considered as timing sources for automatic synchronization reconfiguration. Examples of these are the linear extensions off of a DDM-2000 ring. This type of interface is considered a linear interface, and the system treats it as such with regards to synchronization.

Table 5-5 lists the synchronization references available on DDM-2000 OC-3 and OC-12 system topologies.

Table 5-5. Available Synchronization References

System	Manually Provisionable	Automatically Reconfigurable
OC-3 Linear	Main, Fn-C	Main, Fn-C
OC-3 Rings	Main-1, Main-2, Fn-C	Main-1, Main-2, Fn-C
OC-12 Linear	Main-B	Not applicable
OC-12 Rings	Main-B-1, Main-B-2	Main-B-1, Main-B-2

For DDM-2000 OC-3, function unit C, when equipped with an OC-3/IS-3 OLIU, can be selected as an option for automatic synchronization reconfiguration. This is useful in DRI networks where an OC-3 ring is connected through an OC-3/IS-3 optical interface to an OC-12 or FT-2000 OC-48 Lightwave System ring.

In OC-12 Release 5.1 and later ring releases, the sending of DS1 AIS on the output of the BBF2B/BBF4 circuit pack can be provisioned by using the **set-sync** command. Depending on the quality level of the incoming sync messages, this new parameter can be provisioned to send DS1 AIS upon receiving level 5 (default), level 4, level 3, or level 2. Refer to Table 5-3 and Table 5-4 for definitions of quality levels. AIS will be sent as long as the received message is at the provisioned or greater in quality level number.

Examples

In this part, some detailed examples are given to show specifically how the synchronization messages propagate through the DDM-2000 network and assist in the recovery from a fiber failure. Through these examples, one can extend the same concept to any other network that may include different topologies, number of sites, failure locations, and number of BITS clocks.

NOTE:
All nodes in a ring using automatic synchronization reconfiguration must have the synchronization messaging and automatic synchronization reconfiguration features enabled to prevent alarms.

In all of the following examples, if the sync message parameter within the **set-oc3** or **set-oc12** commands has been provisioned to “S byte” for an optical interface, then the equivalent quality level S byte message will be transmitted from that optical interface. The following are equivalent messages:

K2: Sync Quality Unknown is the same as, S1: Sync Trace Unknown

K2: Timing Looped Back is the same as, S1: Don’t Use

K2: Internal Clock is the same as, S1: Traceable SONET minimum Clock

K2: Stratum 3 is the same as, S1: Traceable Stratum 3.

Synchronization Reconfiguration Using an Externally Timed Access Ring

Figure 5-9a shows an externally timed access ring operating in its normal configuration. The DDM-2000 OC-3/OC-12 Multiplexer at the CO (Site A) is externally timed from a BITS clock referenced to a PRS traceable source (host node). The remaining DDM-2000 OC-3/OC-12 Multiplexers are externally timed from a BITS clock referenced to a derived DS1.

The sync quality unknown (SQU) message is sent to indicate where timing is traceable to an external BITS and where it is valid to be used. Automatic synchronization reconfiguration is not an option for externally timed DDM-2000 OC-3/OC-12 Multiplexers; therefore, a change in the synchronization message will not cause an automatic synchronization reconfiguration.

The stratum level of the BITS clock at the CO (Site A) must be equal to or better (more accurate) than the stratum level of the BITS clocks used at the other sites. This is necessary to maintain the stratum level hierarchy.

a) Synchronization Reconfiguration Example (Before Failure)

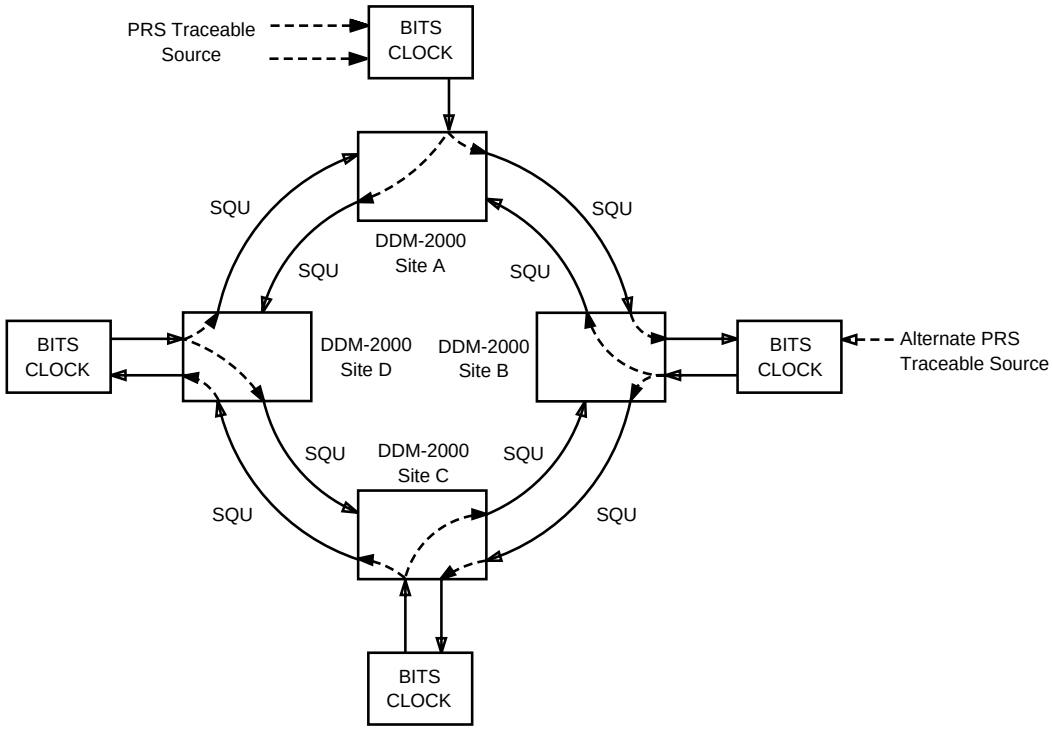


Figure 5-9. Synchronization Reconfiguration — Externally Timed Access Ring (Sheet 1 of 2)

In Figure 5-9b, a fiber has been cut between sites A and B. Immediately the DDM-2000 OC-3/OC-12 Multiplexer at site B changes the format of its derived DS1 to AIS. This forces the BITS clock at site B to enter holdover or switch input source (if a valid one is available). Because automatic synchronization reconfiguration is not available, the synchronization status messages are not used. All other non-host nodes will track the holdover clock at site B. Although no timing loops have been formed, the timing of all non-host nodes will differ from the host node by the accuracy of the holdover clock at site B.

b) Synchronization Reconfiguration (After Failure)

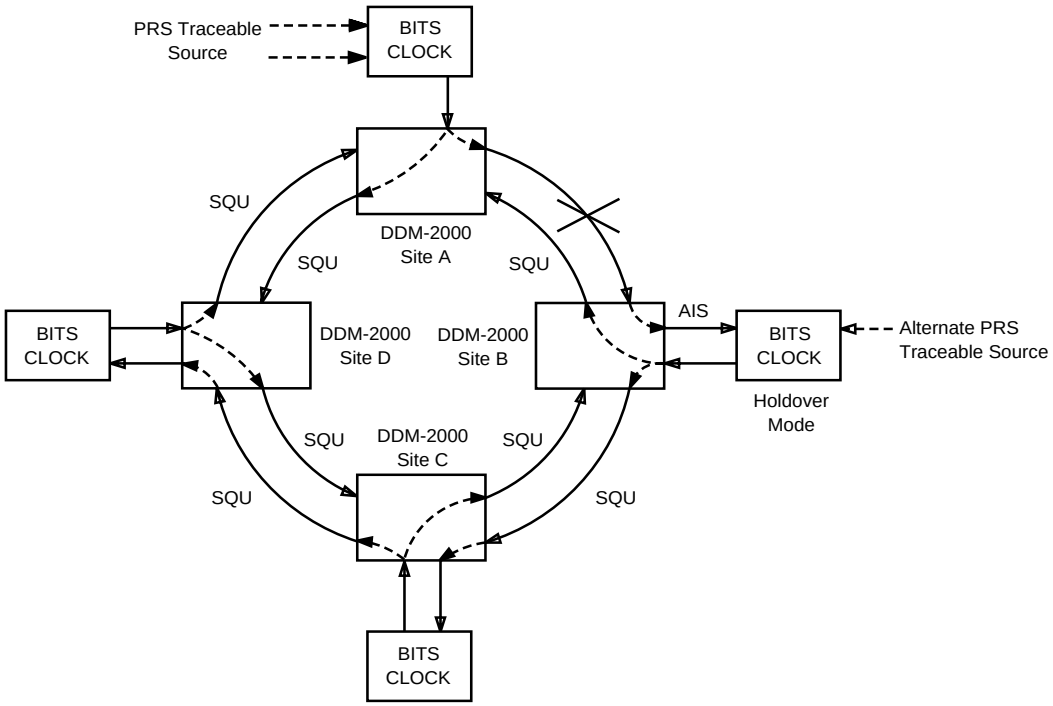
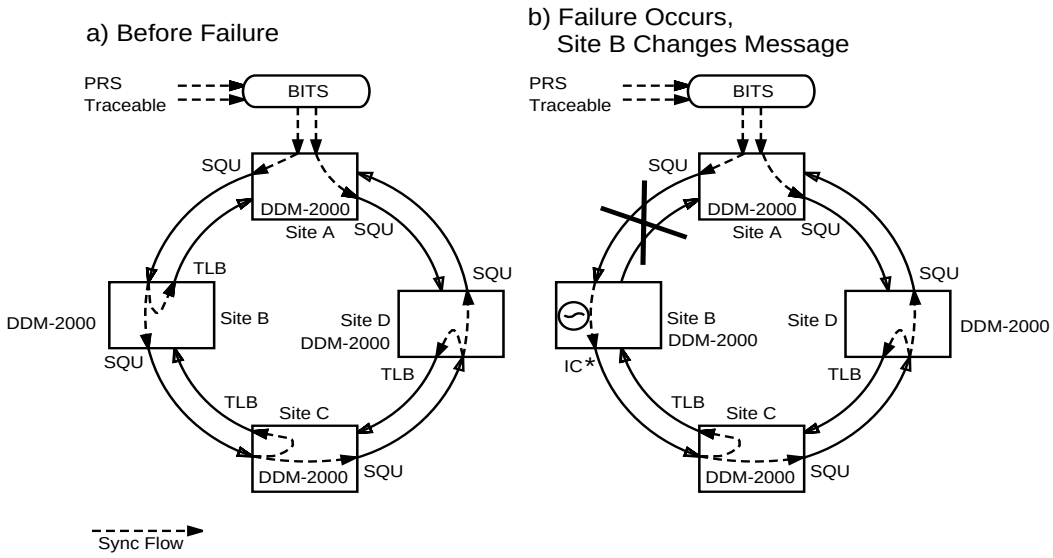


Figure 5-9. Synchronization Reconfiguration — Externally Timed Access Ring (Sheet 2 of 2)

Synchronization Reconfiguration in an Access Ring

Figure 5-10a shows the access ring operating in its normal configuration. The DDM-2000 Multiplexer at the CO is externally timed, and each of the other DDM-2000 Multiplexers are line timed in a counterclockwise direction. The SQU message is sent to indicate where timing is traceable to an external BITS and where it is valid to be used. The timing looped back (TLB) message is sent on the interface that is being used as the line-timing reference because a timing loop would be created if this timing reference were used. Synchronization messaging and automatic synchronization have both been enabled for this network.

In Figure 5-10b, a fiber has been cut between sites A and B. Immediately, the DDM-2000 Multiplexer at site B enters holdover and sends out the internal clock (IC) message to site C. The DDM-2000 Multiplexer at site B cannot switch to line time from site C because it is receiving the TLB message on that interface.

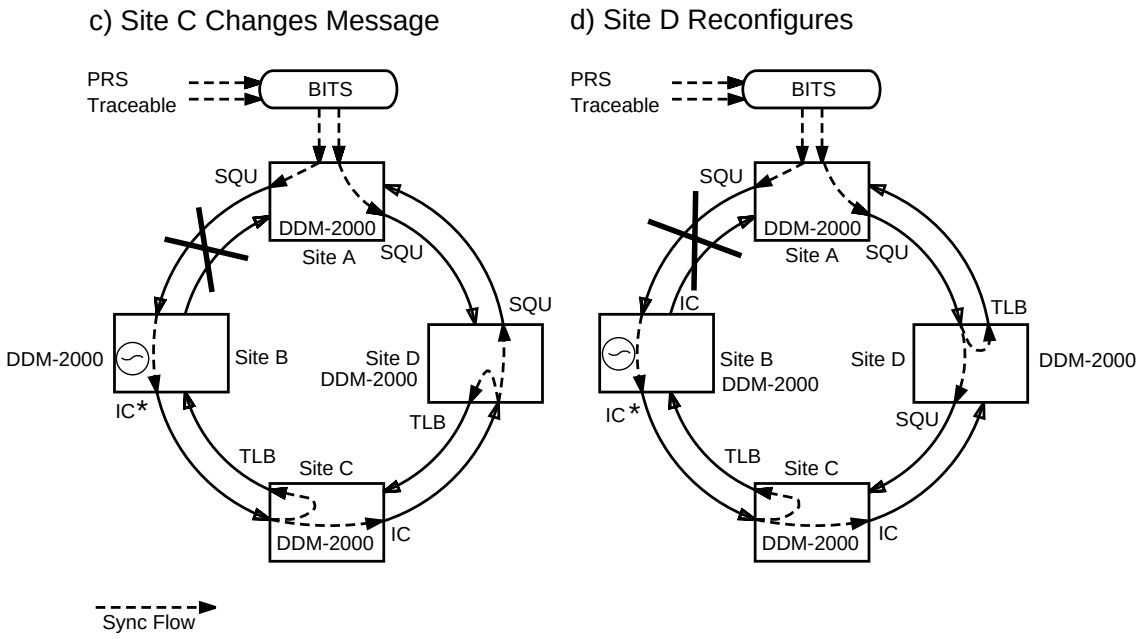


*STRATUM 3 if using a TG3 at site B, or IC if using a TGS.

Figure 5-10. Synchronization Reconfiguration — Access Ring (Sheet 1 of 3)

In Figure 5-10c, the DDM-2000 Multiplexer at site C detects the incoming IC message and sends out the IC message to site D. The DDM-2000 Multiplexer at site C cannot switch to line time from the other rotation because it is receiving the TLB message on that interface and continues to derive timing from Site B.

In Figure 5-10d, the DDM-2000 Multiplexer at site D detects the incoming IC message. Because this DDM-2000 Multiplexer is receiving the SQU message from site A, it will switch to line time from site A because SQU is higher quality than IC. After the switch occurs, the TLB message is sent back to site A and the SQU message is retransmitted to site C.



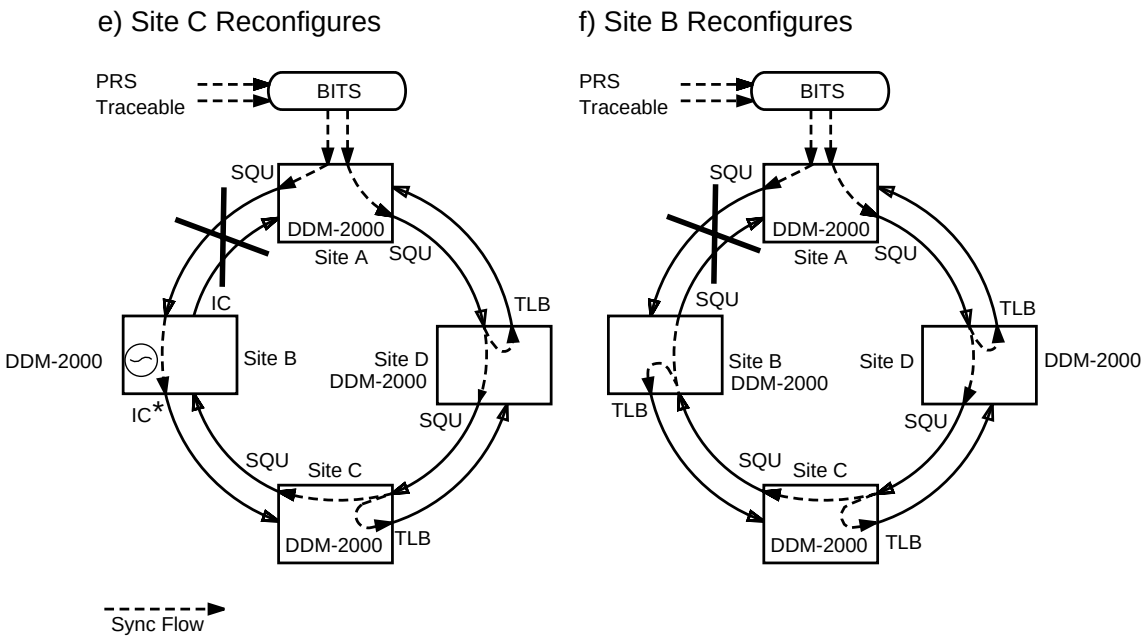
* STRATUM 3 if using a TG3 at Site B, or IC if using a TGS.

Figure 5-10. Synchronization Reconfiguration — Access Ring (Sheet 2 of 3)

In Figure 5-10e, the DDM-2000 Multiplexer at site C detects the incoming SQU message from site D. The SQU message is a better quality message than the IC message being received from site B, so the DDM-2000 Multiplexer at site C switches to line time from site D. After the switch occurs, the TLB message is sent back to site D, and the SQU message is retransmitted to site B.

In Figure 5-10f, the DDM-2000 Multiplexer at site B detects the incoming SQU message from site C. The SQU message is a better quality message than the internal holdover capability, so the DDM-2000 Multiplexer at site B switches to line time from site C. After the switch occurs, the TLB message is sent back to site C, and the SQU message is forwarded to site A.

When the failure clears, the current synchronization arrangement remains in the new configuration unless it is manually switched back or another failure causes it to switch back (nonrevertive operation).



*STRATUM 3 if using a TG3 at site B, or IC if using a TGS.

Figure 5-10. Synchronization Reconfiguration — Access Ring (Sheet 3 of 3)

Network Timing Distribution

DS1 signals have long been used to pass timing information through the network synchronization hierarchy. These DS1 timing references should be transmitted between master and slave clock sources over the most reliable facilities available. In some cases, these DS1 signals also carry traffic. The facility of choice has evolved from T-carrier through asynchronous lightwave systems to SONET lightwave systems. As these systems are upgraded to SONET systems, timing distribution plans should be revisited to ensure the quality of the timing signals are not degraded. With proper planning, SONET can be used to improve the overall quality of the network timing.

Interoffice Timing Distribution

One way SONET can be used to improve the quality of interoffice network timing is through the use of OC-N timing distribution. DDM-2000 supports the evolution to interoffice OC-N timing distribution by providing a DS1 timing output derived from the incoming OC-N signal. The DS1 timing output is traceable to the clock source that times the DDM-2000 subnetwork and has extremely low jitter and wander. This is true regardless of the number of DDM-2000 systems connected in the network. This DS1 can be fed to the local BITS clock which subsequently times the local DDM-2000 and the other equipment in the office. If a BITS clock is not available in the office, the DS1 timing output can be used to time other equipment (including another DDM-2000) directly. DDM-2000 can provide DS1 timing outputs in all supported topologies (for example, point-to-point, add/drop, and ring).

With OC-N timing distribution, the OC-N line signal, rather than a DS1 multiplexed into the SONET payload, will provide a timing transport mechanism better suited to a complex, heavily interconnected SONET network. In this configuration, a DS1 reference from the CO BITS clock still times the OC-N transmitted to the remote site; at the remote site, a DS1 output reference is created directly from the received OC-N signal (Figure 5-11).

The stratum level of the BITS clock at the CO must be equal to or better (more accurate) than the stratum level of the BITS clocks used at the other RT sites. This is necessary to maintain the stratum level hierarchy.

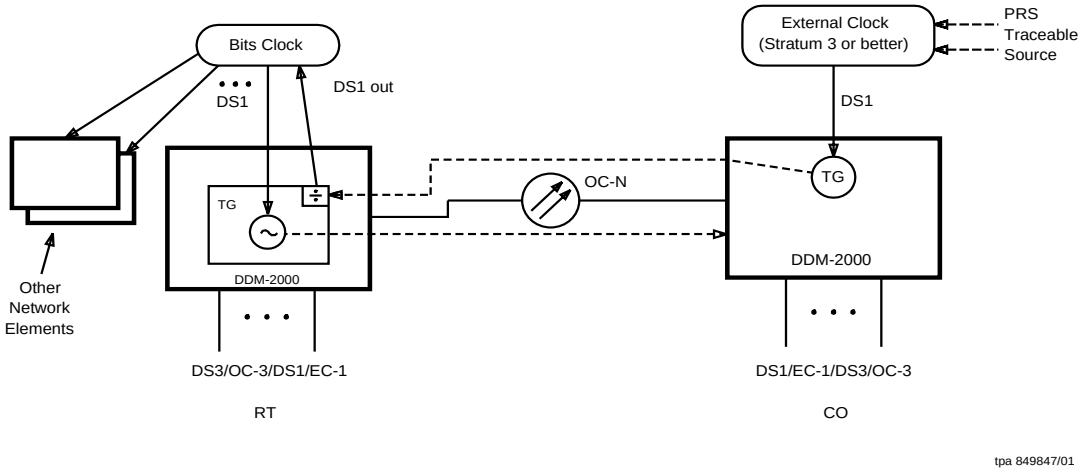


Figure 5-11. OC-N Derived DS1 Timing Reference

OC-N timing distribution has several potential advantages. It preserves transport bandwidth for customer services and guarantees a high-quality timing signal. Also, as the CO architecture evolves to replace DSX interconnects with SONET EC-1 and IS-3 interconnects and direct OC-N interfaces, OC-N distribution becomes more efficient than multiplexing DS1 references into an access facility in the CO.

A previous drawback to using OC-N timing distribution was that network timing failures could not be communicated to downstream clocks via DS1 AIS, since the DS1 signal does not pass over the OC-N interface. With synchronization messaging, clock stratum levels can be passed from NE to NE, allowing downstream clocks to switch timing references without creating timing loops, if a network synchronization failure occurs. If a quality timing reference is no longer available, the DDM-2000 sends AIS over the DS1 interface. If the local OC-N lines fail, DDM-2000 outputs AIS on the DS1 output or an upstream DDM-2000 system enters holdover.

Access Network Timing Distribution

OC-N timing distribution can also be used in access networks or to small COs. In this configuration, a DS1 reference from the CO BITS clock still times the OC-N transmitted to the remote site. The line-timing capability of the DDM-2000 provides the ability to recover OC-N timing. The DS1 timing output feature can be used to also extend timing to customer networks or remote sites. In this case, the DS1 timing output can be used to time switch remotes, DDM-2000 shelves, or other local equipment directly. Ideally, the equipment can provide an external timing reference. Otherwise, the signal must be input to a traffic DS1 port on the external equipment which will tie up some of this equipment's bandwidth. In this configuration, it is important that the DS1 reference to the DDM-2000 in the CO be traceable to the same clock used to source the DS1s being carried to the customer site or small CO. If it is not, slips may occur.

Although an ideal source of timing, OC-N timing distribution, that is, via a DS1 timing output, cannot be used to provide timing in all applications. In cases where the local equipment is not provided with an external timing reference input, or in some private networks where the timing is to be distributed from another private network location, timing will continue to be distributed via traffic-carrying DS1s. In these applications, a stable DS1 timing source can be achieved by ensuring that all elements in the SONET network are directly traceable to a single master clock via line-timing. In this environment, the high-performance desynchronizer design of the DDM-2000 Multiplexer allows a DS1 timing reference to be carried as a multiplexed DS1 payload.

It is recommended that, where possible, the DS1 sources (switch, PBX, or other equipment) be traceable to the same timing source used to time the DDM-2000 SONET network. Multiplexed DS1 reference transport is also consistent with current planning and administration methods. Applications include passing synchronization from the public switched network to a PBX-based private network (Figure 5-12) and synchronizing an end-office remote switch to a larger office's host switch.

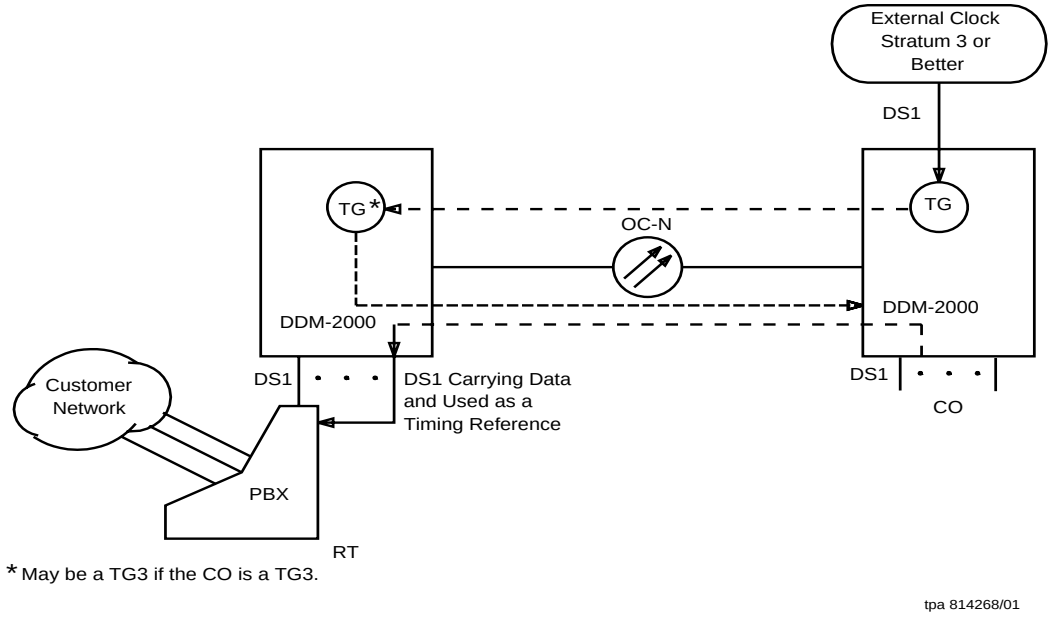


Figure 5-12. Timing from Multiplexed DS1

Operations Interfaces

6

Table of Contents

Overview 6-1

Craft Interface Terminals (CIT) 6-2

- Local Access 6-4
- Using a PC as a CIT 6-6
- Modem Access 6-6
- Remote Access Using the Data Communications Channel (DCC) 6-7
- CPro-2000 Graphical User Interface and Provisioning Tool 6-8

User Panel 6-8

- User Panel LEDs 6-10
- FE SEL Pushbutton 6-10
- ACO/TST Pushbutton 6-10
- UPD/INIT Pushbutton 6-11
- Pushbutton Combinations 6-11

Equipment Indicators 6-12

- FAULT Indicators 6-12
- ACTIVE Indicators 6-12

Office Alarms 6-13

TL1/X.25 Interface 6-14

- ITM SNC 6-15

IAO LAN Interface 6-15

User-Definable Miscellaneous Discretes—Environmental Alarms and Controls 6-16

Table of Contents

Operations Interfaces

6

Overview

This section presents the operations interfaces that support technician and provisioning access to the DDM-2000 OC-12 Multiplexer and allow alarms and status information generated by the system to be reported.

Operations interfaces include:

- Two EIA-232-D craft interface terminal (CIT) interfaces
- User panel controls and indicators
- Equipment status indicators
- Office alarms
- TL1/X.25 interface to an alarm surveillance OS, such as Bellcore's Network Monitoring and Analysis (NMA), Operations Systems/Intelligent Network Elements (OPS/INE), and Lucent Technologies ITM SNC (Integrated Transport Management SubNetwork Controller)
- IntrAOffice LAN (IAO LAN) interface ITM SNC
- User definable miscellaneous discrete environmental alarms and controls
- Order Wire.

Complete detailed information on the OS interfaces is provided in 824-102-151, *DDM-2000 Multiplexers Operations Systems Engineering Guide*.

Craft Interface Terminals (CIT)

The DDM-2000 OC-12 Multiplexer supports three types of access mechanisms through the CIT that can be supported simultaneously.

- Local access
- Remote access via a modem port
- Remote access via the data communications channel (DCC).

A CIT is recommended for installation, maintenance, and administrative activities. The CIT can be either an RS-232-D terminal or personal computer (PC). An *MS-DOS* * PC is required for software download and to run CPro-2000 software. Any PC may function as a CIT when loaded with a commercially-available terminal emulation program. See Section 10, "Technical Specifications," for PC specifications.

Table 6-1 lists some of the terminals and PCs that can be used with the CIT interface. Note that some terminals and PCs may no longer be commercially available but can still be used.

* Registered trademark of Microsoft Corporation.

Table 6-1. Craft Interface Terminals

AT&T 610 terminal	*DEC*§ VT100 terminal
AT&T 615 terminal	ADM 5A terminal
AT&T 630 terminal	*HP*¶ 2621 terminal
AT&T 730 terminal	*HP* 2623 terminal
AT&T 5425 terminal†	*HP* 110 computer**
AT&T 6286 WGS computer‡	*IBM*†† XT computer
AT&T 6312 WGS computer‡	*Toshiba*‡‡ T1000 computer
AT&T 6386 WGS computer‡	*Toshiba* T12000 computer
AT&T 6300 computer‡	AT&T 6300 Plus computer‡
AT&T *Safari** computer	*NCR*§§ 3170 computer

* Safari is a registered trademark of AT&T.

† Was Teletype 5425 or ATTIS 4425.

‡ These *MS-DOS* (*MS-DOS* is a registered trademark of Microsoft Corporation) PCs were tested with *PROCOMM* (*PROCOMM* is a registered trademark of Datastorm Technologies, Inc.) terminal emulation software for maintenance. Other terminal emulation software may also work properly. CTRM software is required for software downloads and is supplied with the DDM-2000 OC-3 and OC-12 Multiplexer software.

§ Trademark of Digital Equipment Corporation.

¶ Registered trademark of Hewlett-Packard Company.

** With terminal emulation software.

†† Registered trademark of International Business Machines Corporation.

‡‡ Registered trademark of Toshiba Corporation.

§§ Registered trademark of NCR Corporation.

Local Access

Figure 6-1 shows the system has two EIA-232-D compatible interfaces for a CIT. The front access interface is configured as data communications equipment (DCE) for direct CIT access (CIT 1). The rear access CIT interface (CIT 2) is configured as data terminal equipment (DTE) to allow a permanent modem connection without requiring a null modem. However, a null modem is required when connecting a CIT directly to the rear access DTE interface. CIT access via a modem connection is identical to local CIT access.

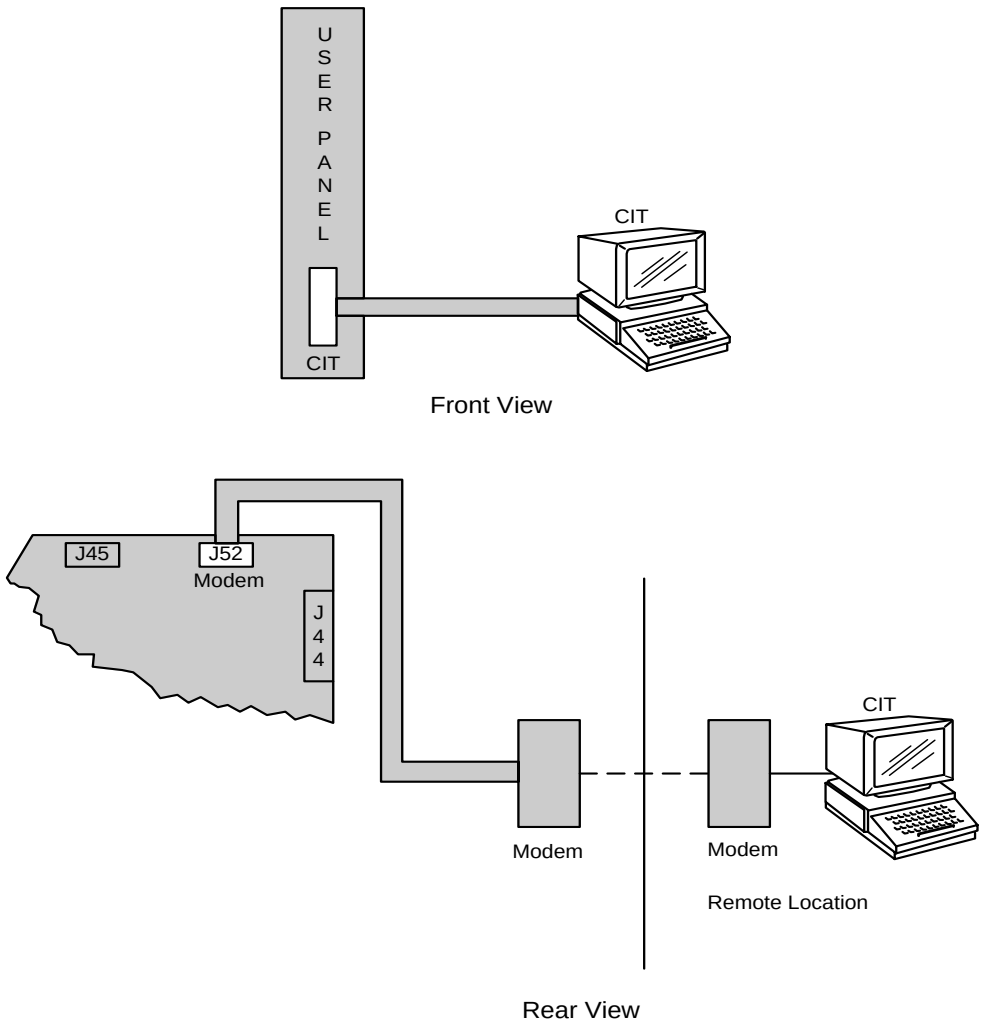


Figure 6-1. Craft Interface Terminal Connectors

The terminal sessions over the front and rear CIT ports (and over the DCC) are independent of one another. Up to three simultaneous CIT login sessions can be supported at any given time (see Figure 6-2).

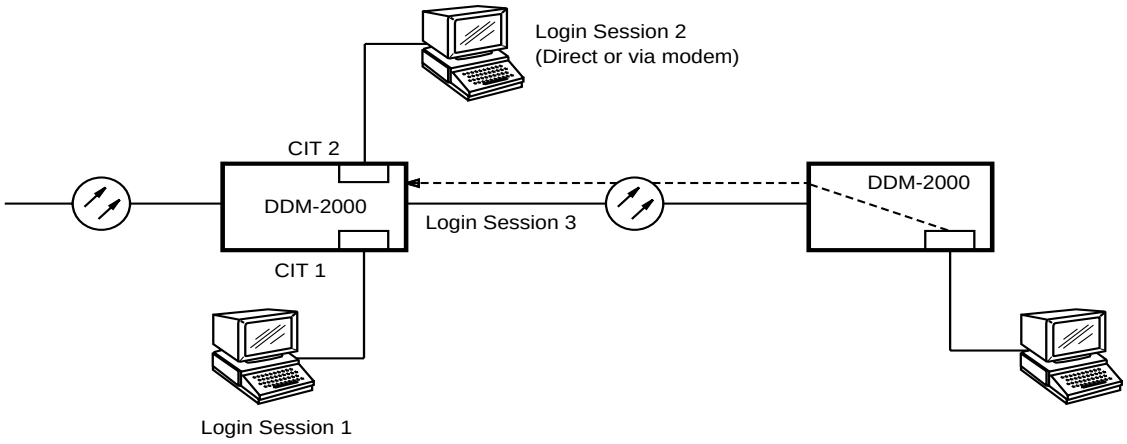


Figure 6-2. Craft Interface Terminal Login Sessions

The DDM-2000 OC-12 CIT interface is based on the Bellcore TL1 language and provides prompt and command modes of operation. On-line context sensitive help is always available to help the technician through command execution. The output messages and reports are presented in easy-to-read sentences and tables. The following functions are provided via the CIT interfaces for the local and remote DDM-2000 OC-12 Multiplexer shelves:

- Loopbacks and testing
- Protection switching
- Performance monitoring (PM)
- Provisioning
- Fault management
- Software downloading
- Security management.

Detailed specifications of the CIT interface are provided in Section 10, "Technical Specifications."

In a bay multiple CIT cabling arrangement, connecting a CIT to any shelf in the bay provides CIT access to that DDM-2000 shelf and any other DDM-2000 OC-3 or OC-12 Multiplexer shelf in that bay. The shelf is selected by using the shelf ID login. In this arrangement, only one front and one rear CIT access can be used. Also with this arrangement, access to shelves in multiple subnetworks can be achieved from the same physical interface. A subnetwork consists of all shelves interconnected with the SONET DCC over OC-N interfaces.

For example, with 6 shelves per bay and 8 bays in a subnetwork, access to 48 shelves is achieved with a single physical interface.

Using a PC as a CIT

In addition to CIT functions, a PC is required for software downloads and facilitates software program updates. Any *MS-DOS* PC can be used to emulate a traditional CIT through a variety of low-cost terminal emulator software packages; thus, an *MS-DOS* PC can serve DDM-2000 OC-12 Multiplexer needs very efficiently. In addition, the DDM-2000 OC-12 Multiplexer user interface can be accessed from within *Windows** (Version 3.0 or later) on an *MS-DOS* PC.

The DDM-2000 OC-12 Multiplexer uses flash erasable program memory (EPROM) devices that can be upgraded through direct download from an *MS-DOS* PC. Upgrades are made available through the distribution of floppy disks compatible with the recommended PCs.

Modem Access

The rear access CIT interface (CIT 2) is configured as DTE to allow a permanent modem connection without requiring a null modem. However, a null modem is required when connecting a CIT directly to the rear access DTE interface. CIT access via a modem connection is identical to local CIT access. Automatic selection (autobaud detection) data rates of 1200, 2400, 4800, 9600, and 19,200 baud are provided for both CIT interfaces.



NOTE:
The DDM-2000 OC-12 Multiplexer CIT interface supports data rates up to 19,200 baud but does not provide flow control. Some terminals and PCs when set for higher data rates will not work properly at these rates with equipment like the DDM-2000 OC-12 Multiplexer that does not provide flow control. The system may appear to stop working when reports or long prompts are displayed. If this happens, try setting the terminal to a lower data rate. The data rate of the DDM-2000 OC-12 Multiplexer is automatically set to match the data rate of the terminal (autobaud).

* Registered trademark of Microsoft Corporation.

The *NCR*[*] 3170 computer and the AT&T *Safari*[†] computer have a built-in modem and meet the modem requirements.

The following stand-alone modems meet the modem requirements and can be used with the DDM-2000 OC-12 system. This is not an exhaustive list of compatible modems:

- *Paradyne*[†] 2224-CEO modem (at 1200 and 2400 baud)
- *Paradyne* 2224 modem (at 1200 and 2400 baud)
- *Paradyne* 4024 modem (at 1200 and 2400 baud)
- *Paradyne* 2296 modem (at 4800 and 9600 baud)
- Hayes [‡] *V-series* Smartmodems
- *Penril* [§] Alliance V.32 modem.

Remote Access Using the Data Communications Channel (DCC)

The DDM-2000 OC-12 system supports CIT remote access from the local terminal to a remote system using the data communications channel (DCC) over OC-N interfaces or the IAO LAN. The DDM-2000 OC-12 system supports one incoming remote login session and one outgoing login session over the DCC at a time. For example, a local user can gain remote access to a remote DDM-2000 in the same subnetwork at the same time a remote user at another DDM-2000 in the subnetwork can gain remote access to the local system. CIT remote login is also supported in multi-vendor subnetworks, but only between DDM-2000 Multiplexers (or from FT-2000 to DDM-2000).

Operations Interworking (OI) also allows remote logins between DDM-2000 and the *SLC*-2000 Access System and from the FT-2000 OC-48 Lightwave System to other Lucent 2000 Product Family systems in the same subnetwork.

---

* Trademark of NCR Corporation.

† Registered trademark of AT&T.

‡ Trademark of Hayes Microcomputer Products, Inc.

§ Registered trademark of Penril Corporation.

CPro-2000 Graphical User Interface and Provisioning Tool

The CPro-2000 Graphical User Interface (GUI) and Provisioning Tool is a *Microsoft** *Windows* based user interface that can optionally be used with the DDM-2000 OC-12 Multiplexer. The tool simplifies and mechanizes administration, maintenance, and provisioning operations. With the tool a user can:

- Display and control cross-connections at each NE in a ring and the entire ring, including dual ring interworking (DRI) (for example, drop and continue paths at DRI nodes).
- Obtain and display graphical images of the ring configuration, equipment, and cross-connections.
- Perform an analysis of the ring to detect provisioning errors.
- Retrieve and store data about a selected NE.
- Backup and restore provisioning information including cross-connections, DS1 port options, DS3 port options, EC-1 port options, and OC-3 line options.

In response to a user, the tool automatically compiles and sends all the necessary commands to perform a task. If the user is provisioning cross-connections, for example, the tool automatically prevents provisioning errors by comparing the new provisioning information with the ring inventory. For more information, see 365-576-130, *CPro-2000 User Manual,* Release 7.0. See Section 10, "Technical Specifications," for PC requirements to use the tool.

User Panel

The user panel for the Group 4 shelf, shown in Figure 6-3, provides system-level information and control functions, while the ACTIVE and FAULT LED on each faceplate provide circuit pack level information. These features let many operations tasks (for example, fault isolation or circuit pack replacement) to be performed when a CIT or external test equipment is not available.

The user panel is a factory-installed unit mounted next to the right-hand flange. Additional LEDs and controls are mounted on the SYSCTL faceplate to support basic operations, administration, and maintenance functions without a CIT.

* Registered trademark of Microsoft Corporation.

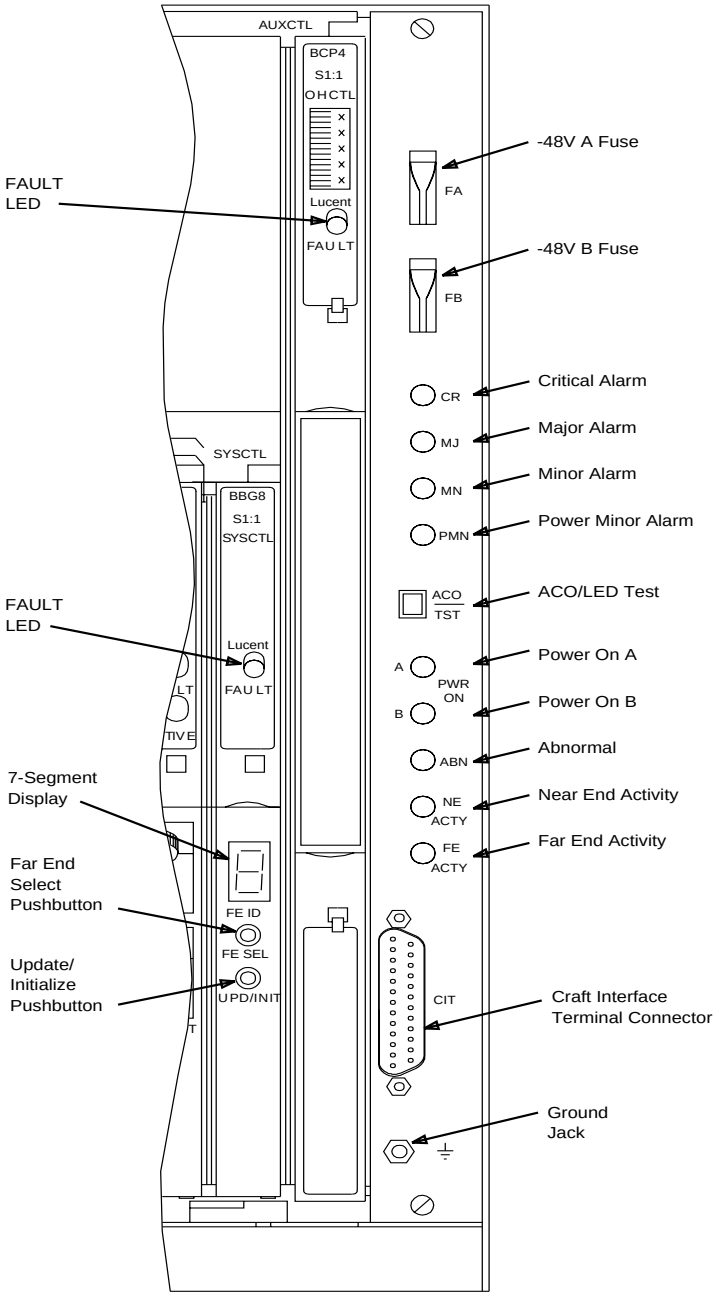


Figure 6-3. User Panel for Group 4 Shelf

User Panel LEDs

The user panel LEDs show a composite of all alarms and status conditions in the local shelf. The composite is defined as follows:

- The highest level alarm LED (CR, MJ, PMN, or MN) of all alarms at the local shelf is lit. (At most, one alarm LED will be lit at any time.)
- The ABN LED is lit if an abnormal condition exists on this shelf.
- The ACO LED is lit if the alarm cutoff function is active on this shelf.
- Each PWR ON LED is lit if the local shelf is receiving –48 V power from its power feeders.
- The NE ACTY LED is lit if any alarm, ABN, or "activity" condition exists on this shelf.

When this composite information is being displayed on the user panel, the 7-segment FE ID is blank.

FE SEL Pushbutton

In previous DDM-2000 OC-12 releases the FE SEL pushbutton allowed technicians to see far-end DDM-2000 conditions from the local shelf. Starting with OC-12 Release 7.0 and all later OC-12 TARP releases, when the FE SEL pushbutton is pushed for the first time, the FE ID display shows "L" and the user panel LEDs show the conditions of the local shelf only.

Each time the FE SEL pushbutton is pushed again within 15 seconds, the FE ID display will show the local shelf address (with the decimal point), and the user panel LEDs will again show a composite of the alarm and status condition of that same shelf.

ACO/TST Pushbutton

The ACO/TST pushbutton tests all the LEDs on the shelf. All LEDs on the shelf will be lit while the pushbutton is pressed. If the ACO pushbutton is pressed and held for more than 2 seconds, the three digits of the software release number are displayed in the 7-segment FE ID display. If there are any active alarms when the ACO pushbutton is pressed, the audible office alarms will be silenced and the ACO LED (part of the pushbutton) on the user panel will be lit.

UPD/INIT Pushbutton

This pushbutton is used to initialize a controller when it is first installed in a shelf, to update the system's internal equipment inventory when signals or equipment are removed from the shelf, and when circuit pack options are changed. The system automatically detects new equipment or signals added to the shelf. In these cases, it is not necessary to push the UPD/INIT pushbutton.

An optical switch on the BBG8/BBG8B SYSCTL circuit pack latch causes a suspension of controller operations and an “F” to be displayed on the controller panel display when the latch is pulled. Closing the latch causes a controller reset.

Pushbutton Combinations

The three pushbuttons described previously are used in combinations to perform seven functions. Table 6-2 lists the functions. These functions are used as part of the procedures described in the TOP section of this manual (Volume II).

Table 6-2. DDM-2000 OC-12 Pushbutton Combinations

Function	Pushbutton		
	ACO/TST	UPD/INIT	FE SEL
1. Update		Press	
2. SYSCTL Initialization *		Press	
3. Remove SYSCTL †	Press		Press
4. Software version	Hold		
5. LED test	Hold		
6. Alarm cutoff	Press		
7. Software download †		Hold	Hold

* Used after a SYSCTL is replaced. Press pushbutton during the 10-second interval that the CR LED on the user panel is flashing.

† See TOP section of this manual (Volume II) for detailed procedures.

Equipment Indicators

FAULT Indicators

Red FAULT indicators are provided on all circuit packs. Retainer cards and the BBF5 JMPR circuit pack do not have LEDs. The circuit pack FAULT indicator is lit whenever a failure has been isolated to that pack.

Common failures (for example, power, synchronization, control, etc.) do not cause the FAULT indicators on all circuit packs affected by the failure to be lit; only the FAULT indicator on the failed pack is lit.

FAULT indicators on high- and low-speed transmission interface and timing circuit packs are flashed when a failure of the incoming signal is detected (for example, LOS, LOF, LOP, or crossing of the signal fail or signal degrade threshold).

The FAULT LED on the BBG9 OHCTL blinks when a failure of the DCC from a far-end shelf is detected.

ACTIVE Indicators

A green ACTIVE indicator is provided on each 1x1, 0x1, and 1+1 protected circuit pack. It indicates which circuit packs, "service" and/or "protection," are active (carrying service) at any given time.

Although there is no ACTIVE LED on each low-speed circuit pack to indicate it is carrying service, the status of the circuit packs can normally be determined without the CIT. If a service DS1 circuit pack FAULT LED is lit and the DS1 protection circuit pack FAULT LED is not lit, then the protection circuit pack is carrying service and the failed circuit pack can be removed. The exception to this rule is if a manual protection switch has been executed. In this case, the ABN LED on the user panel will be lit and the user will have to use a CIT to check the status of the system.

Office Alarms

The DDM-2000 OC-12 Multiplexer provides relay contacts for wiring to the office audible and visual alarms. Contacts are provided for each alarm condition: CR (critical), MJ (major), and MN (minor).

The MJ and CR contact closures are designed to allow these office alarms to be ORed together and reported as an office MJ alarm.

The CR alarms are fail-safed against power failures. They are activated even if the shelf loses both power feeders.

The audible office alarms for a given site are silenced through activation of the ACO function. Visual alarms are not extinguished by the ACO function.

An alarm hold-off delay is provided, to prevent transient failures from causing unnecessary maintenance activity. The office alarms will not be activated unless a condition of greater duration than the alarm hold-off delay occurs. When a failure clears, an alarm clear delay prevents premature clearing of the alarm.

As with the user panel indicators, when multiple alarms are active, the highest level office alarm (audible and visual) is activated. When the highest level alarm clears, the office alarm "bumps down" to the next highest level active alarm.

If the ACO function has been activated to silence all active audible alarms, then when a "bump down" occurs the audible alarms remain silent. (That is, the lower level visual alarm is activated, but the corresponding audible alarm is not re-activated.) If another alarm occurs while the ACO is active, the highest level audible alarm is activated even if the new alarm is a lower level condition. (For example, if a MJ and MN alarm were active and silenced via the ACO and another MN alarm occurred, the MJ audible alarm would sound.)

See Section 8, "Administration and Provisioning," for more information.

TL1/X.25 Interface

The DDM-2000 OC-12 Multiplexer supports a TL1/X.25 interface via a rear access, synchronous, EIA-232-D port capable of speeds of 1200, 2400, 4800, 9600, and 19,200 baud to control and report alarm and status conditions and PM data to an alarm surveillance OS such as Bellcore's NMA. This TL1/X.25 interface provides detailed information such as identifying specific circuit packs and facilities.

The TL1 maintenance messages of the DDM-2000 OC-12 Multiplexer are based on Bellcore's TR-NWT-000833, Issue 3, Rev. 1, Issue 4, Supplement 1, and Issue 5, Rev. 1. The TL1 provisioning messages of the DDM-2000 OC-3 Multiplexer are based on Bellcore's TR-NWT-000199, Issue 2, and TA-NWT-000199, Issue 6, Supplement 1.

The DDM-2000 serves as the TL1/X.25 GNE for DDM-2000 TL1-RNEs. DDM-2000 can now serve as the TL1/X.25 GNE for FT-2000 TL1-RNEs (as an alternative to FT-2000's existing capability to serve as the TL1/X.25 GNE for DDM-2000 TL1-RNEs). ITM SNC (see following paragraph) or other vendor NEs, such as Tellabs *TITAN*, may also be the TL1/X.25 GNE for DDM-2000 TL1-RNEs. The reverse is not necessarily supported; the DDM-2000 can not serve as a TL1/X.25 GNE for Tellabs *TITAN* R5.0.

The GNE serves as a single interface to the OS for the Lucent NEs in the same Lucent 2000 Product subnetwork, using X.25 interfaces. The GNE receives operations information from all the Lucent NEs through the DCC and reports this information, as well as its own information, to the OS. The operations information is in the form of TL1 messages. Through the GNE, the OS can send TL1 commands to any Lucent NE in the subnetwork.

The OS can use more than one NE as a GNE to provide redundancy and/or to distribute TL1 message volume across multiple X.25 links. For example, two NEs could each be connected via their TL1/X.25 interface to the same type of OS with one GNE serving as a backup for the other.

Autonomous and command/response messages are also supported. Section 10, "Technical Specifications," provides detailed specifications for the X.25 interface. Detailed information about engineering a subnetwork with multiple DDM-2000 GNEs and the input and output parameters for TL1 messages is provided in 824-102-151, *DDM-2000 Multiplexers Operations Systems Engineering Guide*.

ITM SNC

ITM SNC is an element management system that supports SONET NEs such as the Lucent Technologies' DDM-2000, FT-2000, *SLC*®-2000, and the Fujitsu® Lightwave Multiplexer (FLM). ITM SNC provides fault, provisioning, configuration, and security management functions via a Graphical User Interface (GUI). Through these functions, ITM SNC is able to support communication multiplexing or concentration, to provide network security, and to record all database changes. ITM SNC also provides a cut-through capability, allowing the ITM SNC user to access an NE through its native command set.

ITM SNC operates as an enhanced graphical tool and as a general configuration management aid. It provides NE, port, cross-connection, and path provisioning, as well as flow-through from provisioning operations systems (OSs) to NEs. ITM SNC also provides fault management through subnetwork alarm and event pre-processing prior to sending fault information to a network surveillance system such as the Network Monitoring and Analysis-Facility (NMA-F).

IAO LAN Interface

DDM-2000 OC-3 R13.0 and OC-12 R7.0 support an IntrAOffice LAN (IAO LAN) interface for operations data communications. The IAO LAN is necessary to support the following ITM SNC R5.0 features:

- ITM SNC as the TL1-GNE for DDM-2000
- ITM SNC software download to DDM-2000.*

Because the IAO LAN is effectively an extension of the SONET DCC, the IAO LAN may also be used to join multiple, otherwise separate subnetworks. All NE-to-NE OI features that are supported by DDM-2000 OC-3 R13.0 and OC-12 R7.0 over the DCC are also supported over the IAO LAN.

The IAO LAN interface is a software-only enhancement to DDM-2000 OC-3 R13.0 and OC-12 R7.0. The current DDM-2000 overhead controller (OHCTL) circuit packs already support the IAO LAN interface (via an RJ45 connector). DDM-2000's IAO LAN interface is compatible with 10BaseT Ethernet hubs operating at 10 Mb/s over 4-wire twisted pair cables (per Bellcore GR-253, ANSI/IEEE 802.2 [ISO 8802-2] and ANSI/IEEE 802.3 [ISO 8802-3]).

See also 824-102-144, *Lucent Technologies 2000 Product Family Multi-Vendor Operations Interworking Guide.*

* This feature will be useful when upgrading from DDM-2000 OC-3 R13.0 and OC-12 R7.0 to subsequent releases.

User-Definable Miscellaneous Discretes—Environmental Alarms and Controls

To allow monitoring and control of equipment in a DDM-2000 OC-12 Multiplexer, a set of user-definable miscellaneous discrete environmental alarms and controls is provided.

Twenty-one miscellaneous discrete alarm/status points are provided to monitor environmental conditions in a DDM-2000 shelf (open door, high temperature, etc.). The first 14 points and points 16 through 21 are activated by contact closures. The fifteenth point (External Minor) is for monitoring of remote structure power and fan apparatus (for example, DC power shelf failure); this point is activated by a –48 volt input.

Four control points are provided to control equipment (pumps, generators, etc.) at remote terminal sites. When activated, the control points provide a contact closure between the control point output and ground.

OS access to all miscellaneous discretes alarm/status points (1 through 21) is provided via TL1/X.25. Figure 6-4 shows OS access to miscellaneous discretes through the DDM-2000 Multiplexer at the CO. Access to all miscellaneous discrete alarm/status points is also provided through the CIT. The state of the control points can be reported, but not controlled, through the CIT; control points are activated by the TL1 command “OPR-EXT-CONT.”

The names and alarm levels of the 21 alarm/status points and the names of the four control points can be provisioned through the CIT in remote systems. (Refer to the **`set-attr-env, set-attr-cont, rtrv-attr-env,`** and **`rtrv-attr-cont`** commands in Section 11, "Commands and Reports.")

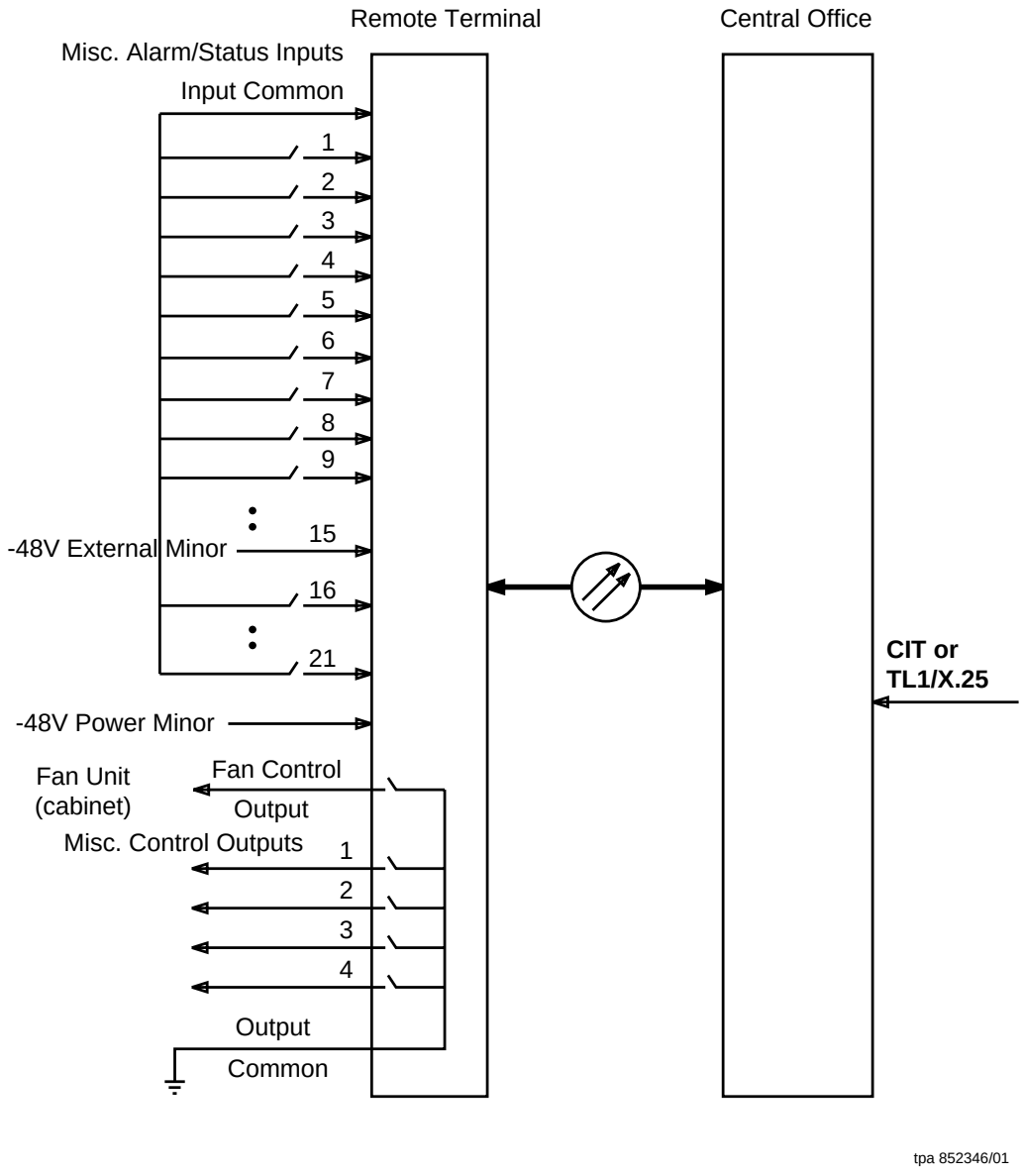


Figure 6-4. Miscellaneous Discretes

Circuit Pack Descriptions

7

Table of Contents

Overview 7-1

Introduction 7-1

Compatibility 7-2

Universal Optical Connector 7-2

Control 7-4

- Control Circuit Packs 7-4
- BBG8/BBG8B SYSCTL Circuit Pack Description 7-5
  - Purpose of Circuit 7-5
  - BBG8/BBG8B SYSCTL Faceplate Controls and Indicators 7-5
  - General Description of Operation 7-6
  - Detailed Description of Operation 7-6
  - BBG8/BBG8B SYSCTL Hardware Setting 7-10
  - BBG8/BBG8B SYSCTL Quick Reference Summary 7-11
- BCP4 OHCTL Circuit Pack Description 7-12
  - Purpose of Circuit 7-12
  - Faceplate Indicator 7-12
  - General Description of Operation 7-13
  - Detailed Description of Operation 7-13
  - OHCTL Quick Reference Summary 7-15

Synchronization 7-16

- Synchronization Functions 7-16
- BBF2B/BBF4 TGS/TG3 Circuit Pack Description 7-16
  - Purpose of Circuit 7-16

Table of Contents

TG Faceplate Indicators 7-17
General Description of Operation 7-18
Detailed Description of Operation 7-19
TG Hardware Settings 7-22
TG Quick Reference Summary 7-24

Transmission 7-25

■ BBG11 3DS3 Circuit Pack Description 7-25
Purpose of Circuit 7-25
BBG11 3DS3 Faceplate Indicators 7-25
General Description of Operation 7-26
Detailed Description of Operation 7-26
BBG11 3DS3 Hardware Settings 7-30
BBG11 3DS3 Quick Reference Summary 7-31

■ BBG11B 3DS3 Circuit Pack Description 7-32
Purpose of Circuit 7-32
BBG11B 3DS3 Faceplate Indicators 7-32
General Description of Operation 7-33
Detailed Description of Operation 7-33
BBG11B 3DS3 Hardware Settings 7-37
BBG11B 3DS3 Quick Reference Summary 7-38

■ BBG12 3STS1E Circuit Pack Description 7-40
Purpose of Circuit 7-40
BBG12 3STS1E Faceplate Indicators 7-40
General Description of Operation 7-41
Detailed Description of Operation 7-41
BBG12 3STS1E Hardware Settings 7-44
BBG12 3STS1E Quick Reference Summary 7-45

■ BCP3 TSI FLEX Circuit Pack Description 7-46
Purpose of Circuit 7-46
BCP3 Faceplate Indicators 7-46
General Description of Operation 7-47
Detailed Description of Operation 7-47
BCP3 Quick Reference Summary 7-50

Table of Contents

- 21D/21D-U OLIU Circuit Pack Description 7-51
  - Purpose of Circuit 7-51
  - 21D and 21D-U OLIU Faceplate Indicators 7-51
  - General Description of Operation 7-52
  - Detailed Description of Operation 7-52
  - 21D/21D-U OLIU Quick Reference Summary 7-55
- 21G/21G-U/21G2-U OLIU Circuit Pack Description 7-56
  - Purpose of Circuit 7-56
  - 21G/21G-U/21G2-U OLIU Faceplate Indicators 7-56
  - General Description of Operation 7-57
  - Detailed Description of Operation 7-57
  - 21G/21G-U OLIU Hardware Settings 7-61
  - 21G/21G-U/21G2-U OLIU Quick Reference Summary 7-62
- 23G/23G-U OLIU Circuit Pack Description 7-64
  - Purpose of Circuit 7-64
  - 23G/23G-U OLIU Faceplate Indicators 7-64
  - General Description of Operation 7-65
  - Detailed Description of Operation 7-66
  - 23G/23G-U OLIU Quick Reference Summary 7-69
- 23H/23H-U OLIU Circuit Pack Description 7-70
  - Purpose of Circuit 7-70
  - 23H/23H-U OLIU Faceplate Indicators 7-70
  - General Description of Operation 7-71
  - Detailed Description of Operation 7-72
  - 23H/23H-U OLIU Quick Reference Summary 7-75
- 177B Apparatus Blank Description 7-76
  - Purpose of Apparatus Blank 7-76
- 177C Apparatus Blank Description 7-77
  - Purpose of Apparatus Blank 7-77

Table of Contents

Circuit Pack Descriptions

7

Overview

This section provides a detailed functional description of the DDM-2000 OC-12 Multiplexer circuit packs.

Introduction

The circuit packs in the DDM-2000 OC-12 Multiplexer are divided into three main categories:

- Control circuit packs
  - — BBG8/BBG8B system controller (SYSCTL)
  - — BCP4 overhead controller (OHCTL)
- Synchronization circuit pack
  - — BBF2B timing generator (TGS)
  - — BBF4 timing generator 3 (TG3)
- Transmission circuit packs
  - — BBG11/BBG11B 3DS3 low-speed interface (3DS3)
  - — BBG12 3STS1E low-speed interface (3STS1E)
  - — BCP3 STS-1 time slot interchange — flexible (TSI FLEX)
  - — 21D/21D-U IS-3 optical line interface unit (OLIU)
  - — 21G/21G-U/21G2-U OC-3 OLIU (long reach 1310 nm)
  - — 23G/23G-U OC-12 OLIU (long reach 1310 nm)
  - — 23H/23H-U OC-12 OLIU (long reach 1550 nm).

Compatibility

The BBG8/BBG8B SYSCTL, BBF2B TGS, BBF4 TG3, 21D/21D-U OLIU, and 21G/21G-U/21G2-U OLIU circuit packs are common to both the DDM-2000 OC-3 and OC-12 Multiplexers.

Universal Optical Connector

Circuit packs having a "-U" after their designation indicate that these circuit packs have a universal optical connector.

The following circuit packs are available with the connector:

- 21D-U OLIU
- 21G-U/21G2-U OLIU
- 23G-U OLIU
- 23H-U OLIU.

This connector (Figure 7-1) is a two-part connector consisting of a faceplate-mounted block and an optical buildout. The faceplate block optionally supports an *ST®*, SC, or FC-type optical buildout.

A 0 dB *ST*-type connector is shipped as standard. Optional SC, or FC 0 dB, or attenuated buildouts can be ordered separately. See Section 10, "Technical Specifications," for a list of universal buildout attenuators.

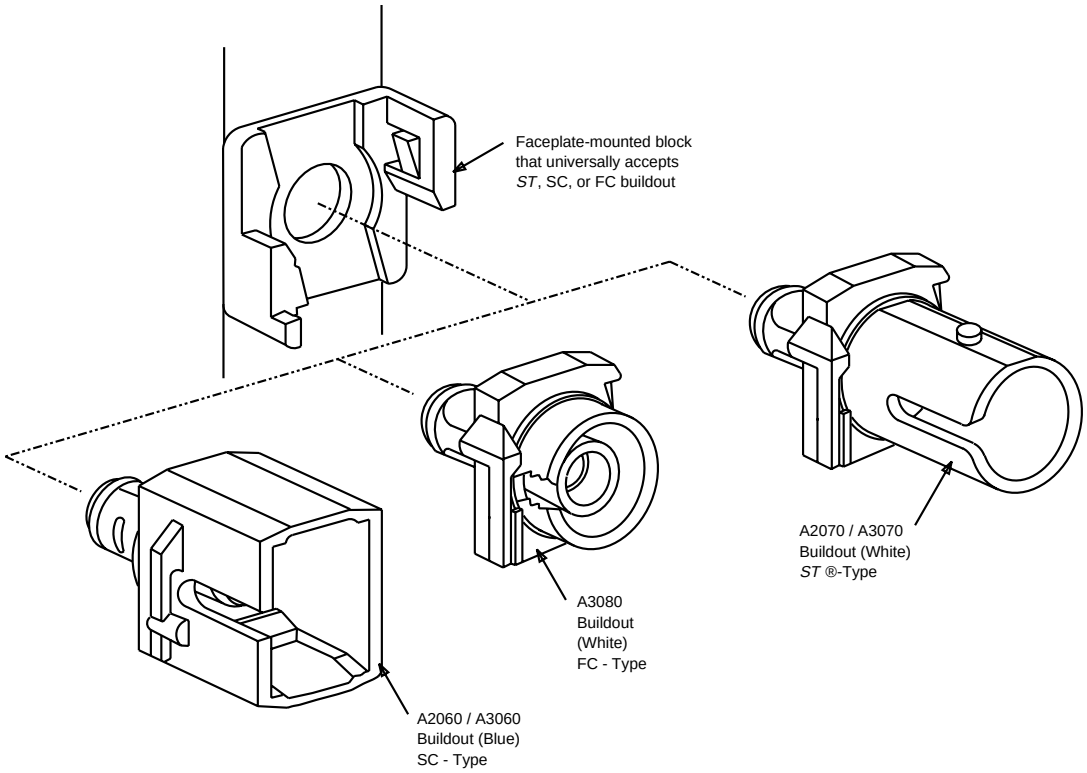


Figure 7-1. Universal Optical Connector

Control

The control system controls and reports the status of the transmission signal through the DDM-2000 OC-12 Multiplexer. All system features are implemented or supported through the control system. However, transmission is unaffected by control system failure. If a controller does fail, protection switches are not done. Therefore, if there is another circuit pack failure requiring a protection switch along with the controller failure, service may be affected depending on the function of the failed pack. The control system continuously monitors the equipment to determine if a protection switch is necessary and to provide equipment performance information.

The control system in each shelf in a subnetwork can communicate with the control system of other shelves in that subnetwork via the synchronous optical network (SONET) section data communications channel (DCC). This allows a user at one point in the subnetwork to control the shelves throughout the network. All system features are implemented or supported through the control system.

Control Circuit Packs

There are two control circuit packs, the BBG8/BBG8B SYSCTL and the BCP4 OHCTL. Both the SYSCTL and OHCTL are required for all applications.

BBG8/BBG8B SYSCTL Circuit Pack Description

Purpose of Circuit

The BBG8/BBG8B SYSCTL circuit pack is the main system controller in the system. Together with its companion OHCTL, it has control over all shelf functions and provides all user interfaces into the system. The BBG8/BBG8B SYSCTL must be used with the BCP4 OHCTL.

BBG8/BBG8B SYSCTL Faceplate Controls and Indicators

The BBG8/BBG8B SYSCTL circuit pack faceplate controls and indicators are shown in Figure 7-2. The SYSCTL has a red FAULT LED and a 7-segment numeric LED display, as well as the FE SEL and UPD/INIT pushbuttons on its faceplate. The red FAULT LED lights on detection of a circuit pack failure.

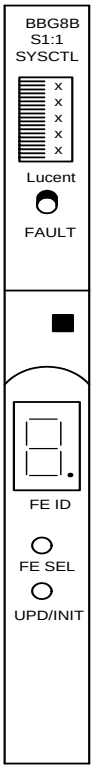


Figure 7-2. BBG8/BBG8B SYSCTL Circuit Pack

An optical switch on the BBG8/BBG8B SYSCTL circuit pack latch causes a suspension of controller operations and an "F" to be displayed on the controller panel display when the latch is pulled. Closing the latch causes a controller reset. These controls and indicators are discussed in more detail under "User Panel" in Section 6, "Operations Interfaces."

General Description of Operation

The SYSCTL circuit pack provides the majority of the control functions on the shelf. These include circuit pack monitoring, performance monitoring (PM), protection switching, and user interfaces.

The SYSCTL, which contains a microprocessor, controls links to all other circuit packs in the system and links to user interfaces. The processor also provides link access procedure (LAPD) and LAPD packet data processing to support SONET section DCC.

Detailed Description of Operation

Control Circuitry

Processor . Figure 7-3 provides an overall block diagram of the SYSCTL circuit pack. This processor is the highest level processor in the system.

Memory

Program Flash-EPROM . The main program is stored in the flash-EPROM, which combines the nonvolatility of EPROM with the in-circuit reprogramming ability of electrically erasable programmable read-only memory (EEPROM). Electrically Erasable Programmable Read-Only Memory FEPROM allows in-service software upgrades to be performed locally or remotely without replacing the SYSCTL circuit pack. Program upgrades of remote DDM-2000 OC-12 shelves can also be done via the overhead channel from the central office (CO). Of course, software upgrades may also be accomplished by replacing circuit packs with packs that have already had software upgrades.

RAM . The main processor's random access memory (RAM) is used to store all volatile information, such as system alarms, PM information, and parameters for the main processor's operating system.

EEPROM . All nonvolatile parameters, such as provisioning, are stored in the EEPROM, which maintains its data indefinitely during a power loss.

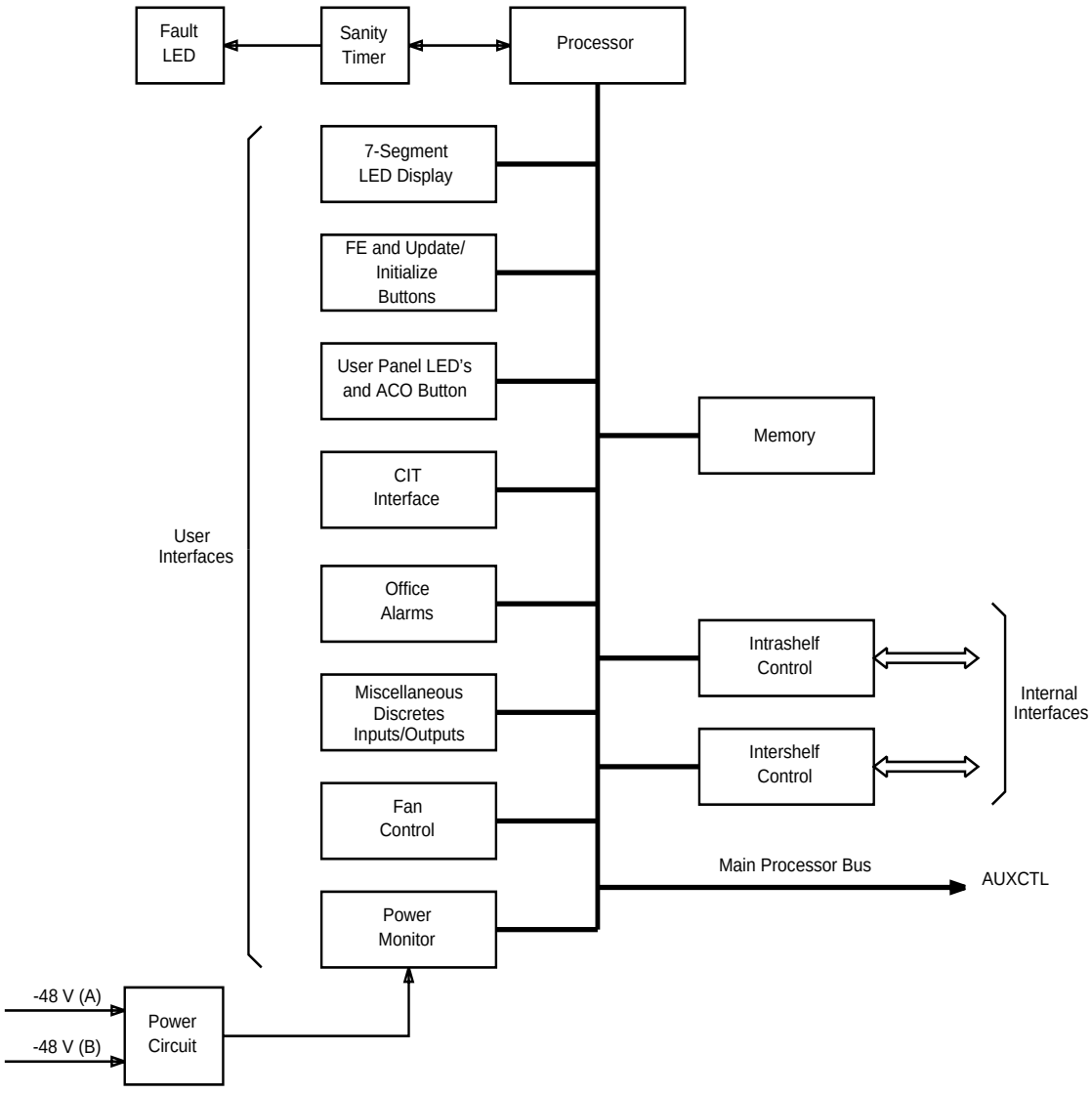


Figure 7-3. BBG8/BBG8B SYSCTL Circuit Pack Block Diagram

Transmission/Timing Circuit Pack Interfaces

The main processor can read and write parameters on the transmission circuit packs through a custom serial interface called the intra-shelf control bus. These circuit packs have a built-in serial link receiver which provides an address map into the device. Through this interface, the processor accesses the custom devices and circuit pack parameters, as well as a small EEPROM which stores each circuit pack's inventory information (Common Language *CLEI*[*] code, date of manufacture, etc.). Through this link, the main processor can also light the faceplate LEDs on the circuit packs.

Redundancy has been built into this bus to allow a pack to be switched out of service in the event of a failure within a circuit pack.

Operation Interfaces

The SYSCTL supports all of the operations interfaces described in Section 6, "Operations Interfaces."

OC-12 Transport Overhead Channel

The OHCTL terminates an overhead channel from each main and function unit slot in the shelf, passing information to the SYSCTL over the intra-shelf processor bus.

---

* Common Language is a registered trademark and CLEI, CLLI, CLCI, and CLFI are trademarks of Bell Communications Research, Inc.

Power Monitoring and Fan Control

The SYSCTL monitors the two –48 volt feeders and generates an alarm if one fails. It also monitors AC power in a remote terminal application via a power minor alarm input closure and can control the external fan, based on an on-board temperature sensor. The system also monitors the fan control relay for contact failure.

If the voltage to the shelf drops below the safe operating voltage, the system will suspend normal operations and wait for safe operating voltage to return. This is referred to as "brownout protection." Assuming a sufficient voltage level, an "L" will be displayed on the SYSCTL. The BBG8 operates in integrated grounding (-48VRTN connected to frame ground) architecture systems. The BBG8B operates in either integrated or isolated grounding (-48VRTN not connected to frame ground) architecture systems.

Interface to Other DDM-2000 OC-12 Shelves

The SYSCTL interfaces with SYSCTLs of other DDM-2000 OC-12 shelves through intershelf cabling. This interface allows the user to access each DDM-2000 OC-12 shelf in a bay via a modem or craft interface terminal (CIT) connected to any shelf in that bay.

Power Circuitry

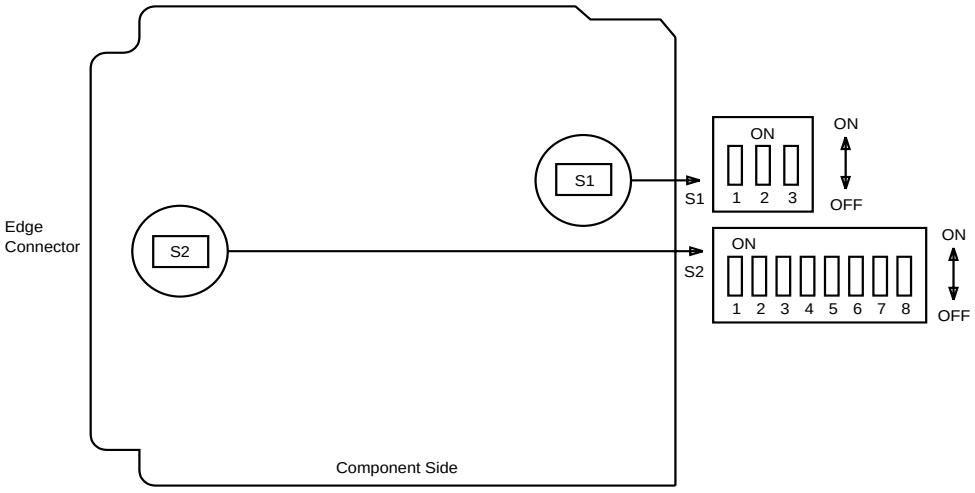
The SYSCTL receives two sources of –48 volts which are diode ORed, fused, and filtered prior to conversion to a +5 volt source to power the rest of the circuit pack.

BBG8/BBG8B SYSCTL Hardware Setting

The BBG8/BBG8B has two hardware switches, Switch 1 (S1) for Product Identification (see Figure 7-4) and Switch 2 (S2) for TBOS Termination used with Release 5.x and earlier releases. Settings for S2 are not applicable for Release 7.0 and later releases.

Switch 1 (S1) Settings

VALUE	S1-1	S1-2	S1-3
DDM-2000/*SLC*-2000/ DDM-2000 FiberReach	OFF	OFF	OFF



Notes:

1. The switch is set by moving the slide toward the desired position.
2. The FAULT LED will also light if the companion OHCTL is not inserted.

Figure 7-4. BBG8/BBG8B SYSCTL Option Switches

BBG8/BBG8B SYSCTL Quick Reference Summary

Interface Functions

Intra-shelf interface functions performed by the SYSCTL are as follows:

- Direct control of other circuit packs via a serial control link and intra-shelf control bus
- Control of circuit pack and user panel LEDs
- Detecting the presence of, and identifying, circuit packs installed in the system.

Craft Interface:

- Local and remote craft interface automatically provisioned to 300, 1200, 2400, 4800, 9600, or 19,200 baud
- Provides interface for all advanced provisioning, PM, administration, and maintenance activities.

User Panel

- Alarm and status indicators
- Controls.

Telemetry Functions

Telemetry functions provided by the SYSCTL are as follows:

- Miscellaneous discrete environmental alarms and control.

Maintenance Functions

Maintenance functions provided by the SYSCTL are as follows:

- Automatic reset on powerup
- Fault detection, isolation, and reporting
- Protection switching control of other circuit packs
- Inventory information (*CLEI* code, date of manufacture, etc.).

BCP4 OHCTL Circuit Pack Description

Purpose of Circuit

The OHCTL circuit pack is used in conjunction with the BBG8/BBG8B SYSCTL. It provides overhead channel interfaces for the system.

Faceplate Indicator

The OHCTL circuit pack faceplate indicator is shown in Figure 7-5. The red FAULT LED lights on detection of circuit pack failure. The red FAULT LED flashes in the event of a SONET DCC failure.

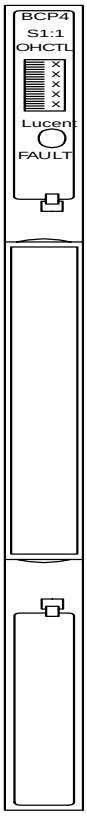


Figure 7-5. BCP4 OHCTL Circuit Pack

General Description of Operation

The OHCTL circuit pack provides the following basic functions:

- Data Communications Channel (DCC)
- X.25 message-based OS interface
- IntrAOffice Local Area Network (IAO LAN) interface.

Detailed Description of Operation

OC-12 Transport Overhead Channel

Figure 7-6 provides an overall block diagram of the OHCTL circuit pack.

The OHCTL terminates an overhead channel from each main and function unit slot. The overhead channel includes a 192 kb per section DCC (SONET bytes D1-D3) and a 64-kb/s order wire channel (SONET byte E1).

User Definable Miscellaneous Discrete Environmental Alarms and Controls

The system provides four miscellaneous discrete control outputs and 21 miscellaneous discrete alarm/status inputs when the DDM-2000 OC-12 is configured as an RT. For this application, the SYSCTL supplies all of the necessary miscellaneous discrete I/O. Alarms are reported via CIT or TL1/X.25. Controls are also via the CIT or TL1/X.25.

X.25 Message-Based Operation Interface

The OHCTL provides the TL1/X.25 interface to Bellcore Network Monitoring and Analysis (NMA) operations system (OS).

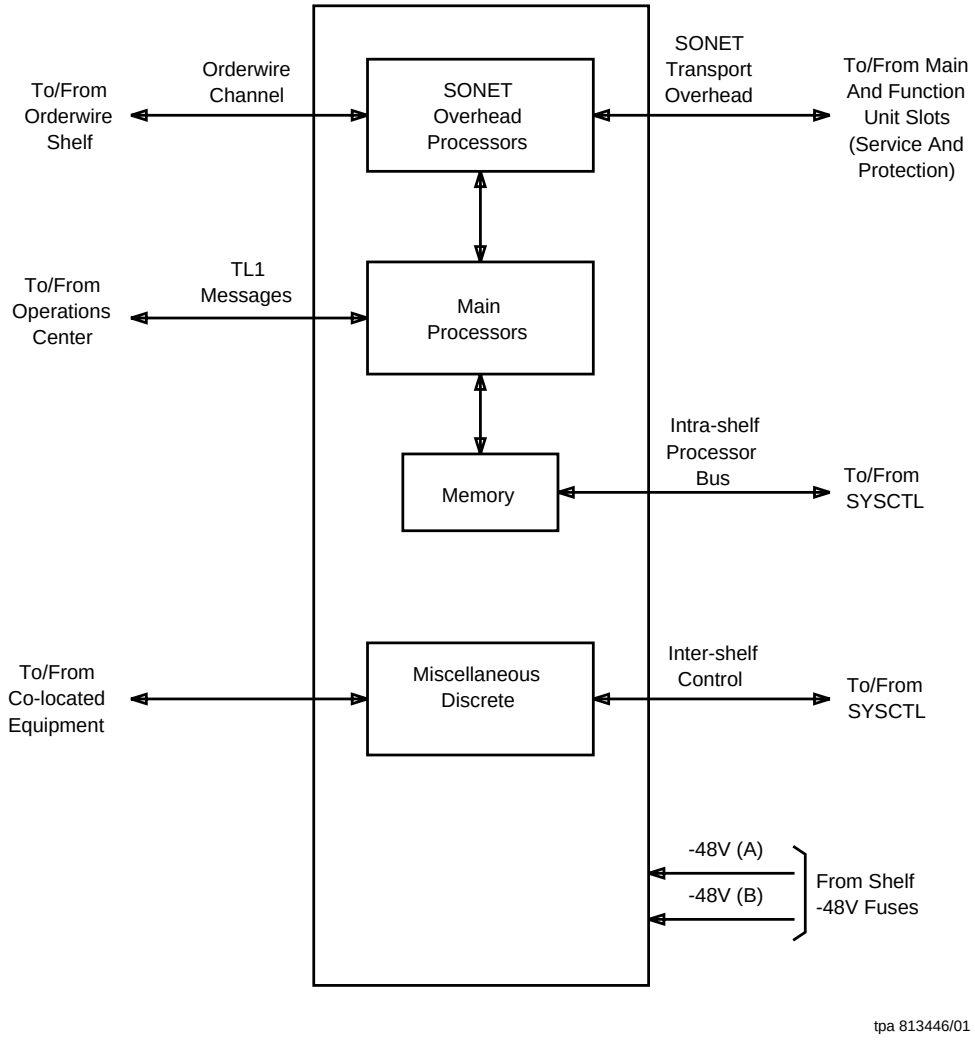


Figure 7-6. BCP4 OHCTL Circuit Pack Block Diagram

Interface Circuitry

The OHCTL circuit pack interfaces with the SYSCTL via the intra-shelf control bus.

Maintenance Features and Modes

Failures of the OHCTL are not service affecting; therefore, there is no protection of the pack.

Power Circuitry

The OHCTL receives two sources of –48 volts which are diode ORed, fused, filtered, and converted to a +5 volts source to power the circuit pack. A failure of the fuse or converter causes the red FAULT LED to light.

OHCTL Quick Reference Summary

Functions

Major functions of the OHCTL circuit pack are as follows:

- SONET overhead channel interface to OLIU circuit packs
- User-definable miscellaneous discrete environmental alarm and status outputs for monitoring auxiliary remote site equipment used with a DDM-2000 OC-12 shelf
- An X.25 message-based operations interface
- Inventory information (*CLEI* code, date of manufacture, etc.)
- Intra-office LAN interface.

Synchronization

Synchronization Functions

The DDM-2000 OC-12 Multiplexer supports three synchronization modes:

1. DS1 timing input from stratum 3 or better office clock for CO applications
2. Free-running in CO applications when external timing inputs are not available
3. Line (formerly loop) timing for remote timing functions.

In addition, the BBF2B/BBF4 TGS/TG3 circuit pack provides a DS1 timing output that is used for network synchronization and allows line (formerly loop) timing and DS1 Output timing to be derived from the main OLIUs.

The timing circuit packs distribute clock and frame signals, derived from the selected reference source, to the transmission circuit packs.

BBF2B/BBF4 TGS/TG3 Circuit Pack Description

Purpose of Circuit

The synchronous timing generator (TG) circuit pack provides timing for the shelf. Other functions include a derived DS1 output for use as a reference signal by a building integrated timing supply (BITS) or a DS1 MULT capability for synchronizing other shelves in the bay. The derived DS1 is traceable to timing from the main OLIUs.

TG Faceplate Indicators

The TG circuit pack faceplate indicators are shown in Figure 7-7.

The red FAULT LED lights on detection of circuit pack hardware failure or improper switch settings.

The red FAULT LED flashes in the event of an incoming DS1 timing reference failure.

The green ACTIVE LED lights when the circuit pack is providing timing to the rest of the shelf.

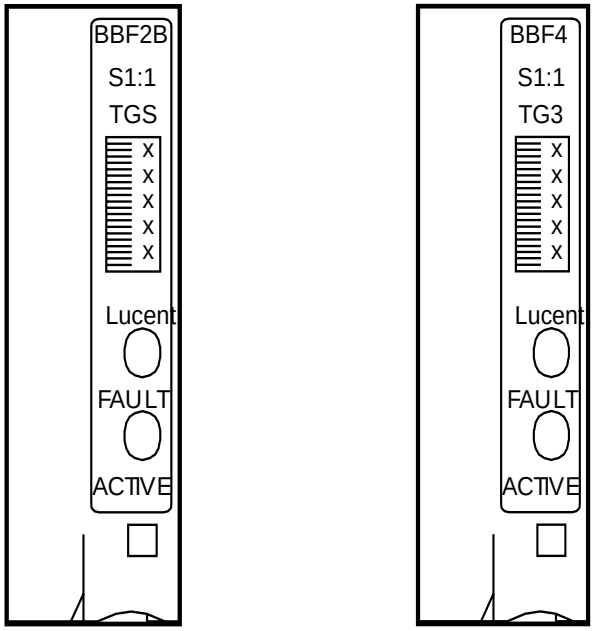


Figure 7-7. BBF2B TGS and BBF4 TG3 Circuit Pack

General Description of Operation

The TG circuit pack provides timing signals to the DDM-2000 OC-12 circuit packs. The TG circuit pack is microprocessor controlled and has the capability to synchronize to external DS1 references or to loop references from an incoming optical signal. The on-board oscillator has sufficient accuracy to provide timing signals without synchronization references for point-to-point systems (free-running) and a DS1 timing output for network timing distribution.

The TG circuit pack supports three timing modes to serve a wide range of DDM-2000 OC-12 synchronization needs: external timing, line (formerly loop) timing, and free-running. In addition, external timing or line (formerly loop) timing with DS1 output provisioned for network synchronization is provided.

In external timing mode, each TG circuit pack accepts one DS1 reference from an external stratum 3 or better clock and one cross-coupled from its companion TG circuit pack. A high-stability digital phase-locked loop (DPLL) removes any transient impairments on the DS1 reference for improved jitter performance.

In line (formerly loop) timing mode, the TG circuit pack derives local shelf timing from the received OC-N signal.

In free-running mode, the TG circuit pack derives timing from a high stability temperature-compensated, voltage-controlled crystal oscillator.

In case of unprotected synchronization reference failure, the TG circuit pack will switch to "holdover mode" and continue to provide system timing, using the internal oscillator to maintain the last known good reference frequency.

DS1 Timing Output

The DS1 Output provided by the TG circuit pack can be provisioned to one of two modes of operation:

- MULT
  - — This mode is normally used to distribute a DS1 timing reference to other shelves in the bay. In this mode, the distributed DS1 Output is buffered from the external DS1 reference that is input to the shelf.
- SYNC OUT
  - — This mode is used to distribute a derived DS1 timing reference to a BITS. In this mode, the distributed DS1 Output is based on the timing signal the TG circuit pack has derived from the received OC-12 signal from the main OLIUs.
  - — If the DS1 output is provisioned for SYNC OUT mode, DS1 AIS will be inserted on detection of unprotected OC-N line failure.

Detailed Description of Operation

Control Circuitry

Figure 7-8 is an overall block diagrams of the BBF2B TGS and BBF4 TG3 circuit packs. The TG circuit pack interfaces with the SYSCTL via the intra-shelf control bus. Through this interface, the SYSCTL monitors the health of the TG circuit pack to provide alarm reporting. The SYSCTL also controls TG circuit pack switching and mode functions, as well as controlling the faceplate LEDs.

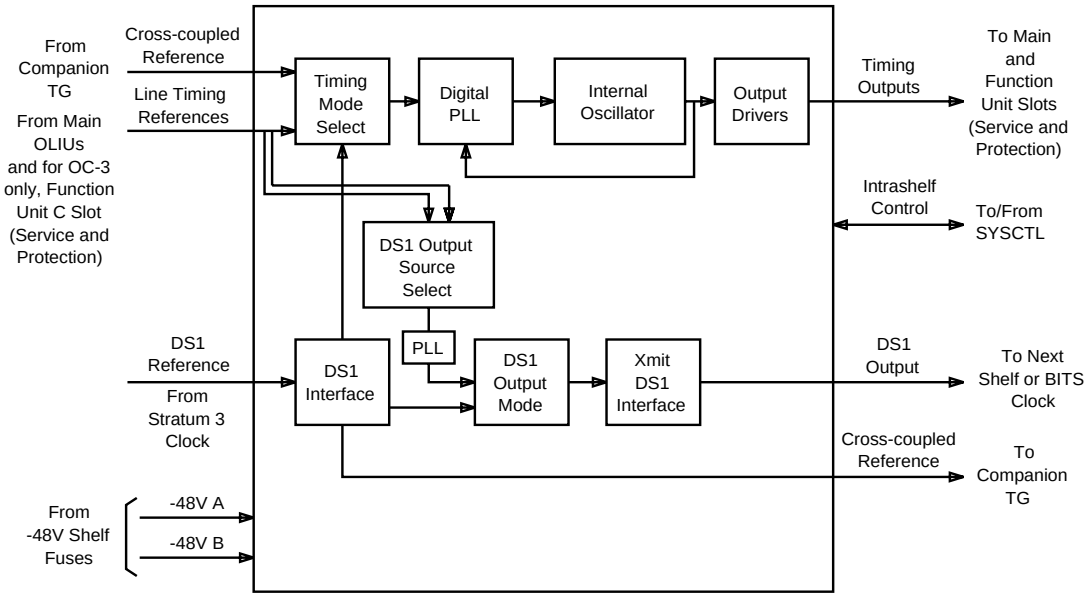


Figure 7-8. BBF2B TGS and BBF4 TG3 Circuit Pack Block Diagram

Timing Circuitry

DS1 External Timing. Each TG circuit pack receives one DS1 reference signal which it monitors and from which it recovers a clock signal. The recovered clock is cross-fed to its companion TG circuit pack in the same shelf. If the microprocessor on one TG circuit pack detects an incoming DS1 reference failure, it will signal the microprocessor on the companion TG circuit pack. Thus, each TG circuit pack has two DS1 references to choose from, one which is input directly and the other cross-fed. Both TG circuit packs will normally select the same DS1 input. A loss of both DS1 references will result in the TG circuit pack entering holdover mode.

Line Timing. The reference signal feeding the phase-locked loop is selected from the internal oscillator or a loop-timing clock derived from the incoming optical line. In line (formerly loop)-timing mode, the OC-N line being selected for transmission is also selected as the timing reference. Loss of both line timing references will cause the TG circuit pack to go into holdover mode to maintain system timing.

Free-Running. For free-running operation, the TG derives timing from a temperature-compensated, voltage-controlled crystal oscillator (TCVCXO) and a digital phase-locked loop (DPLL) with a full temperature range end-of-life accuracy of ±15 parts-per-million (ppm) for the BBF2B TGS, and ±4.6 ppm for the BBF4 TG3.

DS1 Output. The DS1 output port of the TG circuit pack can be provisioned for either MULT or SYNC OUT mode via a hardware switch. In the SYNC OUT mode, the derived DS1 output signal is generated from the incoming OC-N lines through timing synchronization signals from the DDM-2000 OC-12 main OLIUs (main-b-1 or main-b-2), which is the default. In the MULT mode, the DS1 output signal is buffered from an external DS1 input reference. This external reference is typically a DS1 from a building integrated timing supply (BITS).

Selection of these timing synchronization signals for the DS1 output in SYNC mode is controlled by the SYSCTL circuit pack. This selection can be provisioned via software command to "track" the active received side of the OC-N line used for transmission, to always select its timing from the specified OC-12 line (main-b-1 or main-b-2) regardless of its maintenance condition. Loss of timing reference for the DS1 output will result in the insertion of DS1 AIS on this output port.

Holdover. The TG circuit pack has an internal TCVCXO that will maintain shelf timing in the event of an unprotected timing DS1 reference failure (that is, holdover mode). The TGS (BBF2B) will maintain frequency stability to better than a SONET minimum clock (SMC) accuracy. The TG3 (BBF4) will maintain frequency stability to better than a stratum 3 accuracy. Beyond this 24 hour period holdover will gradually return to a free-run accuracy.

Clock Output Functions

Intra-shelf Timing Distribution. The generated timing signals are distributed through output drivers to the main and function unit slots. The TG circuit pack provides eight differential 51.84-MHz master clock signals and eight differential 8-kHz composite STS-1 frame sync signals. In the 8-kHz sync signal, every fourth pulse is stretched to double width, providing an embedded 2-kHz reference for the virtual tributary (VT) superframe synchronization.

DS1 Outputs . The DS1 output port can be provisioned by hardware switches for MULT mode or DS1 timing synchronization (SYNC OUT) mode.

- SYNC OUT Mode
  - — The DS1 output port of the BBF2B TGS circuit pack can be provisioned to be a derived DS1 signal traceable to a received optical line used for network timing distribution. The SYNC OUT capability is available for a DDM-2000 set for external-timing or line-timing.
- MULT Mode
  - — The DS1 output port of the TGS circuit pack can be provisioned to output a buffered copy (at a DSX level) of the DS1 signal at the input port. A DS1 traceable source is applied to the first DDM-2000 shelf. The output of the first shelf is then cabled to the second shelf, and all subsequent shelves fed from the previous ones. In this way, a MULT chain is formed from a single DS1 reference. The MULT capability is only available for a DDM-2000 provisioned for external-timing.

Protection Circuitry

In both external and line (formerly loop)-timing modes, the synchronization references are continuously monitored for error-free operation. If the active reference becomes corrupted, the TG circuit pack will select the standby reference without causing service degradations (that is, hitless reference switching). If both reference inputs are corrupted, the TG circuit pack enters holdover mode where the DPLL holds the on-board oscillator frequency at the last good reference sample while the references are repaired.

In addition, optional 1x1 nonrevertive TG circuit pack protection is provided. When the active TG circuit pack microcontroller determines that its clock output is out of tolerance, it suppresses its timing outputs and signals its TG circuit pack companion unit of its failed condition. The suppressed timing outputs cause a timing hardware switch to the standby TG circuit pack by the transmission circuit packs.

Fault Detection Circuitry

The TG circuit pack has in-service and out-of-service built-in test capability. In-service testing is continuous and errors are reported when they occur to the SYSCTL via the intra-shelf control bus. An out-of-service test is performed whenever the TG circuit pack is inserted or recovers from a transient failure.

The incoming DS1 references are monitored for:

- LOS (128 consecutive zeros)
- DS1 AIS
- LOF
- Excessive out-of-frame count
- Greater than 10^{-3} bit error ratio (BER).

Power Circuitry

The TG circuit pack receives two sources of –48 volts which are diode ORed, fused, and filtered prior to conversion to a +5 volt source to power the rest of the circuit pack. A failure of the fuse or converter causes the red FAULT LED to light.

TG Hardware Settings

The TG circuit pack option switches provide the following functions:

- DS1 Reference Line Coding — Selects either alternate mark inversion (AMI) or AMI with bipolar 8-zero substitution (B8ZS) line coding for both DS1 input and DS1 output.
- DS1 Reference Format — Selects either super frame (SF) or extended super frame (ESF) for both DS1 input and DS1 output.
- Timing Mode — Sets timing mode to free run, external DS1, or line (formerly loop) timed.
- DS1 output mode — Sets DS1 output (SF or ESF "all ones" signal) for intra-shelf timing derived either from DS1 external input or from network timing distribution derived from received line. Reference for DS1 timing output is taken from the main OLIUs.
- Sets equalizer switch for proper cable length when provisioned for SYNC OUT mode. Equalizer settings will be automatically set to shortest cable length when the DS1 output is provisioned for MULT mode.

Figure 7-9 shows the location of the option switches for the BBF2B TGS circuit pack.

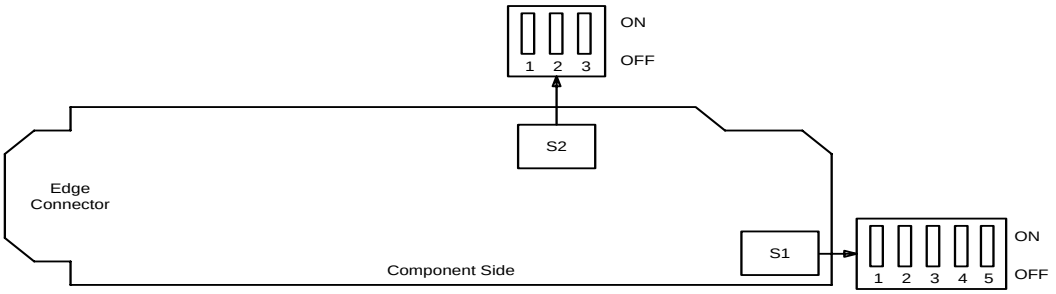


Figure 7-9. TG Option Switches for DDM-2000 OC-3 (Sheet 1 of 2)

Notes:

1. The switches are set by moving the slide toward the desired position.
2. If the invalid switch setting is selected, the FAULT LED lights and an alarm is generated.
3. The main OLIU is the default reference when in Line Timing or SYNC OUT mode.

TG DS1 Line Coding and Frame Format Switch Settings (Note)

DS1 Line Code	Switch S1-1	DS1 Frame Format	Switch S1-2
AMI *	ON	SF *	ON
B8ZS	OFF	ESF	OFF

***Note*:** Controls line coding and frame format for both DS1 input and output.

* Factory default.

TG Timing Mode Switch Settings

Timing Mode	Switch Settings		
	S1-3	S1-4	S1-5 (DS1 Output)
Free-Running	ON	ON	OFF
DS1 External, MULT Mode*	OFF	ON	OFF
Line Timing Main	OFF	OFF	OFF
Line Timing, SYNC OUT Mode	OFF	OFF	ON
DS1 External, SYNC OUT Mode	OFF	ON	ON
Invalid	ON	OFF	ON
Invalid	ON	OFF	OFF
Invalid	ON	ON	ON

* Factory default.

Equalizer Switch Settings

Equalization (Note)	S2-1	S2-2	S2-3
0' to 131'	ON	ON	OFF
131' to 262'	ON	OFF	ON
262' to 393'	ON	OFF	OFF
393' to 524'	OFF	ON	ON
524' to 655'	OFF	ON	OFF
Invalid	OFF	OFF	OFF
Invalid	OFF	OFF	ON
Invalid	ON	ON	ON

***Note*:** Distance in feet for 22 gauge PIC (ABAM) cable.

Figure 7-9. TG Option Switches for DDM-2000 OC-3 (Sheet 2 of 2)

TG Quick Reference Summary

Provisioned Modes

The TG circuit pack can be provisioned through on-board option switches to any one of three timing modes: (a) External timing mode (b) Line (formerly loop) timing mode or (c) Free-running mode.

In addition, the BBF2B TGS circuit pack can be provisioned through on-board option switches to provide a DS1 output for network timing distribution or for shelf timing distribution. Line (formerly loop) timing from the main OC-12 line is the factory default.

Holdover Mode

The holdover mode maintains the last good reference frequency during unprotected failure of external or line (formerly loop)-timing references.

Maintenance and Control

The following maintenance functions are provided on the TG circuit pack: (a) DS1 reference monitoring, (b) TG and OLIU circuit pack protection switching, and (c) inventory information (*CLEI* code, date of manufacture, etc.).

DS1 Output

- DS1 Output (MULT) — a buffered copy of the external DS1 input reference used for intershelf timing
- DS1 Output (SYNC OUT) — derived from received OC-3 line for network timing distribution.

Transmission

The transmission circuit packs are the BBG11 3DS3, BBG11B 3DS3, BBG12 3STS1E, BCP3 TSI FLEX, 21D/21D-U OLIU, 21G/21G-U/21G2-U OLIU, 23G/23G-U OLIU, and the 23H/23H-U OLIU.

BBG11 3DS3 Circuit Pack Description

Purpose of Circuit

The BBG11 3DS3 circuit pack provides a low-speed interface between asynchronous DS3 rate signals and SONET standard STS-1 signals.

BBG11 3DS3 Faceplate Indicators

The BBG11 3DS3 circuit pack faceplate indicators are shown in Figure 7-10. The red FAULT LED is lit by the SYSCTL on detection of the BBG11 3DS3 circuit pack failure or by the loss of the circuit pack +5 V DC. In the event of an incoming signal failure, this LED will flash on and off. The green ACTIVE LED lights when the circuit pack is active (carrying service).

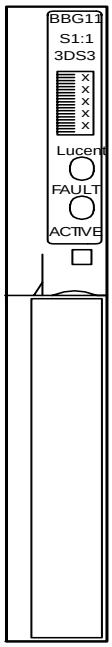


Figure 7-10. BBG11 3DS3 Circuit Pack

General Description of Operation

The BBG11 3DS3 circuit pack provides bidirectional transport of three DS3 signals through the DDM-2000 OC-12 Multiplexer in either clear channel (CC) mode, violation monitor and removal (VMR) mode, or violation monitor (VM) mode by mapping the DS3 into an STS-1 signal. The 3DS3 circuit pack performs maintenance and provisioning functions associated with the STS-1 and DS3 signals and provides access to the STS-1 path overhead. The 3DS3 circuit pack interfaces to the TSI circuit pack at the STS-1 rate, to the DSX-3, and to the SYSCTL, and it receives timing signals from the TSI circuit pack. When provisioned for the clear channel (CC) mode, the 3DS3 can transport any DS3 rate signal that meets specified electrical interface requirements. When provisioned for the VMR or VM mode, the DS3 signal must meet both electrical and DS3 frame format requirements.

Detailed Description of Operation

Transmission Circuitry

Transmit Direction. Figure 7-11 provides an overall block diagram of the BBG11 3DS3 circuit pack. The transmit direction is the direction towards the STS-1 signal, and the receive direction refers to the direction towards the DSX-3. In the transmit direction, the BBG11 3DS3 receives three incoming bipolar 3-zero substitution (B3ZS) encoded DS3 signals from the DSX-3. A closed protection relay contact routes the DS3 signal to a circuit that splits the signal and sends one output to the companion (standby) circuit pack and the other to its own receiver. The BBG11 3DS3 receiver performs equalization and clock recovery, performs B3ZS decoding and optional automatic AIS insertion which it synchronizes to the STS-1 rate; inserts STS-1 path overhead; and transmits the STS-1 rate signal to the TSI circuit packs.

Receive Direction. The BBG11 3DS3 receives STS-1 data from both the active and standby TSI circuit packs, selects one set of STS-1s, performs pointer interpretation, processes and removes the path overhead, desynchronizes the embedded DS3, provides a provisionable VMR function, and then B3ZS-encodes the signal for transmission to the DSX-3. A jumper allows the user to insert or remove a line build-out (LBO) network (225 ft. of 734A type cable equivalent) to provide the required signal level and shape at the DSX-3.

Before the DS3 signal is B3ZS-encoded, a VMR function can be provisioned via the control circuitry for one of three possible modes:

- VMR with DS3 AIS insertion (default)
- VM and AIS insertion without removal of violations
- CC
  - — With DS3 AIS insertion
  - — Without DS3 AIS insertion.

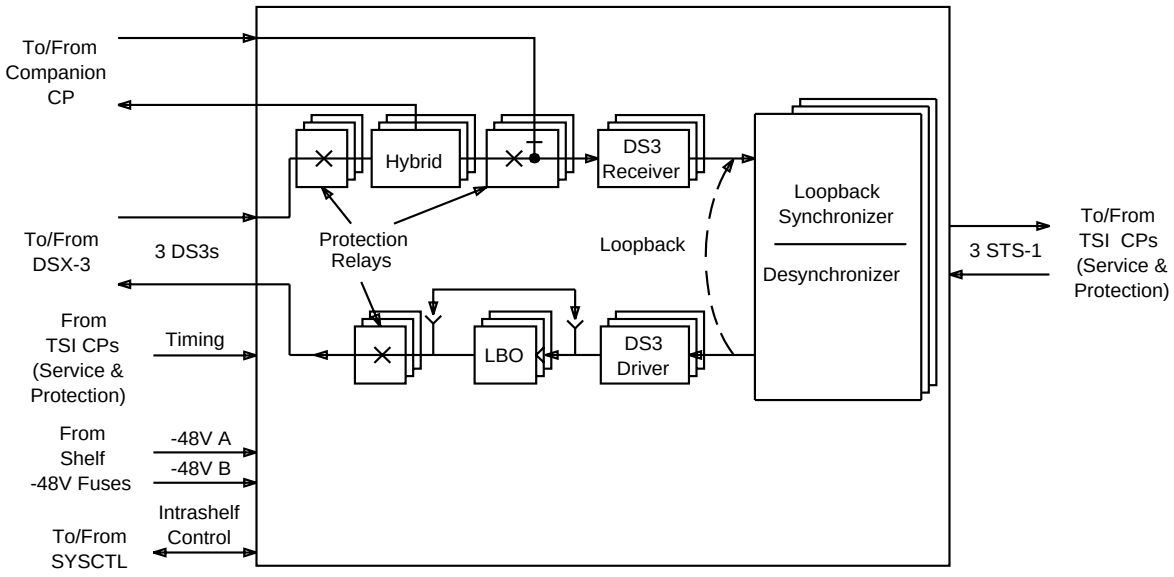


Figure 7-11. BBG11 3DS3 Circuit Pack Block Diagram

Control Circuitry

The BBG11 3DS3 circuit pack interfaces with the SYSCTL via the intra-shelf control bus. Redundancy in the intra-shelf control bus assures the level of control required to perform protection switching and alarming of a faulty circuit pack. The BBG11 3DS3 provides maintenance elements for reporting the status of the circuit pack, status of the incoming STS-1 and DS3 signals, as well as the circuit pack inventory information (*CLEI* code, date of manufacture, etc.). These maintenance elements are used by the SYSCTL for fault detection and isolation. Conversely, the BBG11 3DS3 responds to control signals from the SYSCTL (such as active and fault LED controls).

Timing Circuitry

The BBG11 3DS3 circuit pack derives its timing information from the recovered DS3 clock of the DSX-3 incoming signal. In the transmit direction, a 44.736 MHz clock is recovered from the incoming DS3 signal and is used to recover DS3 data. In the receive direction, a smoothed 44.736 MHz clock is generated by a phase-locked loop to accompany the DS3 signal extracted from the STS-1 payload.

In addition to the recovered DS3 clock, the BBG11 3DS3 circuit pack requires STS-1 timing supplied by the TSI circuit pack, via the circuit pack edge connector, from the backplane.

Protection Circuitry

Optional 1x1 nonrevertive BBG11 3DS3 circuit pack protection is provided. Switch points for the STS-1 side of the BBG11 3DS3 are located on the TSI circuit packs. Switch points for the DS3 side are implemented with relays on the 3DS3 circuit pack. To ensure that the relays can be operated when the circuit pack fails, the relay is controlled by the SYSCTL via the control interfaces. Also, if power to the board is lost, the relay switches autonomously to the standby state. When a new board is inserted, it defaults to the standby state until provisioned active by the SYSCTL.

On the BBG11 3DS3 side, the DS3 inputs from a DSX-3 are sent to both the active and standby BBG11 3DS3 circuit packs. Only the active unit selects the DS3 input. The SYSCTL circuit pack supervises the state of the active and standby units so that the relay state of each is always the inverse of the other. The hybrid on the active unit splits the DS3 input signals and sends them to the standby unit and to its own receiver. To implement a protection switch on the DS3 side, the SYSCTL switches the relays on each unit to their opposite state.

When a BBG11 3DS3 is removed, shorting contacts on the backplane connector operate so that the DS3 input signal from its companion unit is returned for proper termination.

Fault Detection Circuitry

Monitoring and Testing. The BBG11 3DS3 circuit pack has in-service and out-of-service built-in test capability. In-service testing is continuous and errors are reported when they occur to the SYSCTL via the intra-shelf control bus. An out-of-service test is performed whenever the BBG11 3DS3 circuit pack is inserted or recovers from a transient failure.

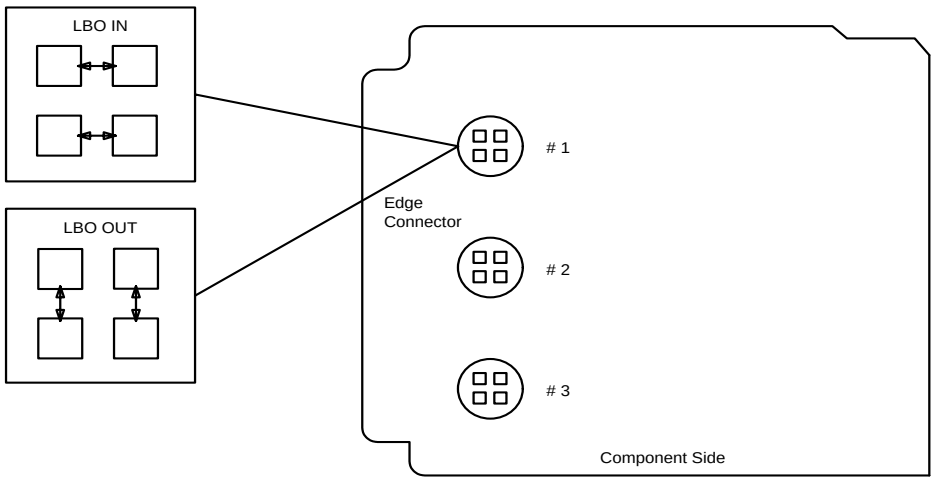
Loopbacks. Two loopbacks are provided for each DS3 interface on the BBG11 3DS3 circuit pack. The terminal loopback bridges the DS3 desynchronizer output signal (transmitted towards the DSX-3) back into the DS3 synchronizer input. Operation of this loopback does not affect the signal transmitted to the DSX-3. The facility loopback bridges the STS-1 output signal to the TSI back towards the DSX-3. Operation of this loopback does not affect the signal transmitted to the fiber. Both loopbacks are controlled by the SYSCTL through the intra-shelf control bus.

Power Circuitry

The BBG11 3DS3 circuit pack receives two sources of –48 volts that are in turn diode ORed, fused, and filtered before conversion to +5 volts to power the rest of the circuit pack. A failure of the fuse or converter causes the red FAULT LED to light.

BBG11 3DS3 Hardware Settings

The location of the BBG11 3DS3 circuit pack line build-out (LBO) jumpers is shown in Figure 7-12. The 3DS3 LBO settings are shown in the table.



3DS3 LBO Settings

Cable Length (Ft)			LBO Setting
734A Cable	Mini-Coax KS-19224	735A Cable	
0 to 225 >225 to 450	0 to 75 >75 to 150	0 to 125 >125 to 250	LBO IN LBO OUT

Figure 7-12. 3DS3 Line Build-Out (LBO) Jumpers

BBG11 3DS3 Quick Reference Summary

Transmit Functions

The 3DS3 circuit pack transmit functions are as follows:

- Receives three B3ZS encoded DS3 signals from a DSX-3
- Recovers three DS3 clocks and nonreturn to zero (NRZ) data
- Synchronizes the data signals to STS-1 signal rate
- Inserts STS-1 path overhead
- Provides three STS-1 signals to the TSI circuit packs.

Receive Functions

The following receive functions are performed by the BBG11 3DS3 circuit pack:

- Desynchronizes the incoming STS-1 signals
- Terminates the STS-1 paths
- Optionally checks and/or corrects P-bit parity errors
- B3ZS encodes the outgoing DS3 signals
- Pre-equalizes the DS3 signals (with line build-out) and transmits them to the DSX-3.

Control Functions

The major control functions are as follows:

- Protection switching for TSI and 3DS3 circuit packs
- STS-1 path overhead processing
- Internal fault detection
- Inventory information (*CLEI* code, date of manufacture, etc.).

Maintenance Signal Functions

The major maintenance signal functions are as follows:

- Detects STS-1 path AIS coming from the fiber
- Detects STS-1 path unequipped signal coming from the fiber
- Inserts DS3 AIS toward the fiber and DSX-3
- Detects DS3 AIS coming from the fiber
- Inserts and detects STS-1 path yellow signal to/from the fiber
- Detects DS3 line failure (LOS and BER).

BBG11B 3DS3 Circuit Pack Description

Purpose of Circuit

The BBG11B 3DS3 circuit pack provides a low-speed interface between asynchronous DS3 rate signals and SONET standard STS-1 signals. The BBG11B provides the same functions as the BBG11 and can be used in place of the BBG11 in all applications. In addition, the BBG11B provides enhanced DS3 PM.

BBG11B 3DS3 Faceplate Indicators

The BBG11B 3DS3 circuit pack faceplate indicators are shown in Figure 7-13. The red FAULT LED is lit by the SYSCTL on detection of the BBG11B 3DS3 circuit pack failure or by the loss of the circuit pack +5 V DC. In the event of an incoming signal failure, this LED will flash on and off. The green ACTIVE LED lights when the circuit pack is active (carrying service).

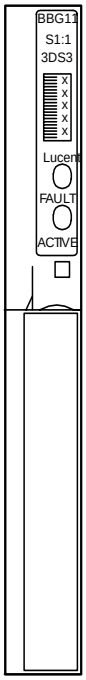


Figure 7-13. BBG11B 3DS3 Circuit Pack

General Description of Operation

The BBG11B 3DS3 circuit pack provides bidirectional transport of three DS3 signals through the DDM-2000 OC-12 Multiplexer in either clear channel (CC) mode, violation monitor and removal (VMR) mode, or violation monitor (VM) mode, by mapping the DS3 into an STS-1 signal. The BBG11B 3DS3 circuit pack performs maintenance and provisioning functions associated with the STS-1 and DS3 signals and provides access to the STS-1 path overhead. The BBG11B 3DS3 circuit pack interfaces to the TSI circuit pack at the STS-1 rate, to the DSX-3, and to the SYSCTL, and it receives timing signals from the TSI circuit pack. When provisioned for the clear channel mode, the 3DS3 can transport any DS3 rate signal that meets specified electrical interface requirements. When provisioned for the VMR or VM mode, the DS3 signal must meet both electrical and DS3 frame format requirements.

Detailed Description of Operation

Transmission Circuitry

Transmit Direction. Figure 7-14 provides an overall block diagram of the BBG11B 3DS3 circuit pack. The transmit direction is the direction towards the STS-1 signal, and the receive direction refers to the direction towards the DSX-3. In the transmit direction, the BBG11B 3DS3 receives three incoming B3ZS encoded DS3 signals from the DSX-3. A closed protection relay contact routes the DS3 signal to a circuit that splits the signal and sends one output to the companion (standby) circuit pack and the other to its own receiver. The BBG11B 3DS3 receiver performs equalization and clock recovery, B3ZS decoding, optional automatic DS3 AIS insertion, and a provisionable VMR function. The BBG11B DS3 then synchronizes and maps the DS3 to the STS-1 rate, inserts STS-1 path overhead and transmits the STS-1 rate signal to the TSI circuit packs.

Receive Direction. The BBG11B 3DS3 receives STS-1 data from both the active and standby TSI circuit packs, selects one set of STS-1s, performs pointer interpretation, processes and removes the path overhead, desynchronizes the embedded DS3, provides a provisionable VMR function, and then B3ZS-encodes the signal for transmission to the DSX-3. A jumper allows the user to insert or remove a line LBO network (225 ft. of 734A-type cable equivalent) to provide the required signal level and shape at the DSX-3.

Before the DS3 signal is B3ZS-encoded (receive direction) or decoded (transmit direction), a VMR function can be provisioned via the control circuitry for one of three possible modes:

- VMR with DS3 AIS insertion (default)
- VM and AIS insertion without removal of violations
- CC
  - — With DS3 AIS insertion
  - — Without DS3 AIS insertion.

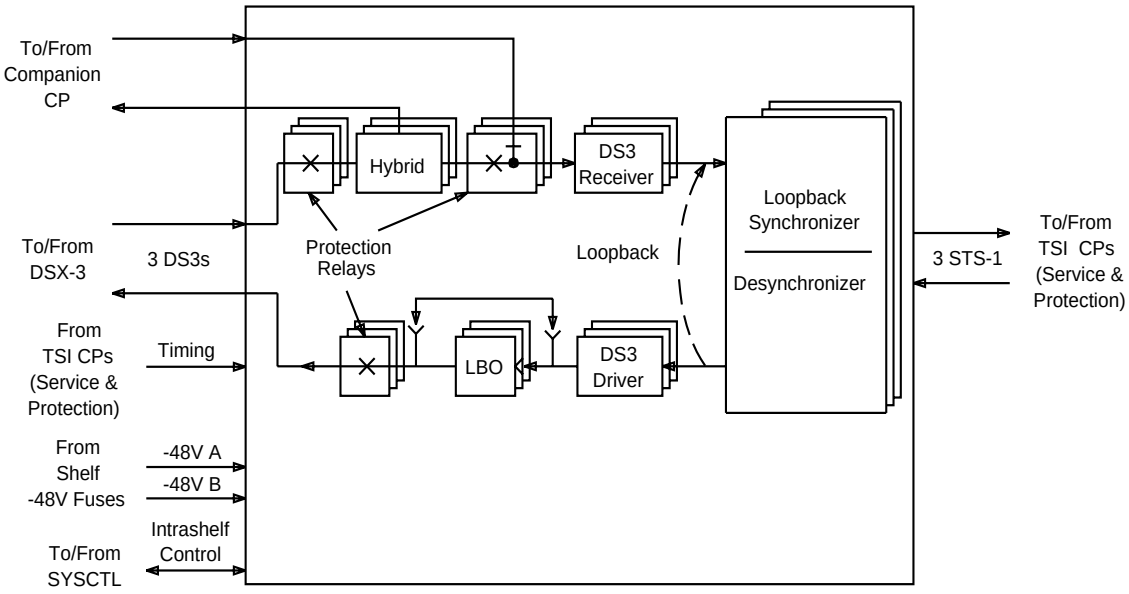


Figure 7-14. BBG11B 3DS3 Circuit Pack Block Diagram

Control Circuitry

The BBG11B 3DS3 circuit pack interfaces with the SYSCTL via the intra-shelf control bus. Redundancy in the intra-shelf control bus assures the level of control required to perform protection switching and alarming of a faulty circuit pack. The BBG11B 3DS3 provides maintenance elements for reporting the status of the circuit pack, status of the incoming STS-1 and DS3 signals, as well as the circuit pack inventory information (*CLEI* code, date of manufacture, etc.). These maintenance elements are used by the SYSCTL for fault detection and isolation. Conversely, the BBG11B 3DS3 responds to control signals from the SYSCTL (such as active and fault LED controls).

Timing Circuitry

The BBG11B 3DS3 circuit pack derives its timing information from the recovered DS3 clock of the DSX-3 incoming signal. In the transmit direction, a 44.736 MHz clock is recovered from the incoming DS3 signal and is used to recover DS3 data. In the receive direction, a smoothed 44.736 MHz clock is generated by a phase-locked loop to accompany the DS3 signal extracted from the STS-1 payload.

In addition to the recovered DS3 clock, the BBG11B 3DS3 circuit pack requires STS-1 timing supplied by the TSI circuit pack, via the circuit pack edge connector, from the backplane.

Protection Circuitry

Optional 1x1 nonrevertive BBG11B 3DS3 circuit pack protection is provided. Switch points for the STS-1 side of the BBG11B 3DS3 are located on the TSI circuit packs. Switch points for the DS3 side are implemented with relays on the 3DS3 circuit pack. To ensure that the relays can be operated when the circuit pack fails, the relay is controlled by the SYSCTL via the control interfaces. Also, if power to the board is lost, the relay switches autonomously to the standby state. When a new board is inserted, it defaults to the standby state until provisioned active by the SYSCTL.

On the BBG11B 3DS3 side, the DS3 inputs from a DSX-3 are sent to both the active and standby BBG11B 3DS3 circuit packs. Only the active unit selects the DS3 input. The SYSCTL circuit pack supervises the state of the active and standby units so that the relay state of each is always the inverse of the other. The hybrid on the active unit splits the DS3 input signals and sends them to the standby unit and to its own receiver. To implement a protection switch on the DS3 side, the SYSCTL switches the relays on each unit to their opposite state.

When a BBG11B 3DS3 is removed, shorting contacts on the backplane connector operate so that the DS3 input signal from its companion unit is returned for proper termination.

Fault Detection Circuitry

Monitoring and Testing. The BBG11B 3DS3 circuit pack has in-service and out-of-service built-in test capability. In-service testing is continuous and errors are reported when they occur to the SYSCTL via the intra-shelf control bus. An out-of-service test is performed whenever the BBG11B 3DS3 circuit pack is inserted or recovers from a transient failure.

Loopbacks

Two loopbacks are provided for each DS3 interface on the BBG11B 3DS3 circuit pack. The terminal loopback routes the DS3 desynchronizer output signal (transmitted towards the DSX-3) back into the DS3 synchronizer input. Operation of this loopback does not affect the signal transmitted to the DSX-3. The facility loopback routes the STS-1 output signal to the TSI back towards the DSX-3. Operation of this loopback does not affect the signal transmitted to the fiber. Both loopbacks are controlled by the SYSCTL through the intra-shelf control bus.

Performance Monitoring

The BBG11B DS3 circuit pack provides PM circuitry for the following performance parameters:

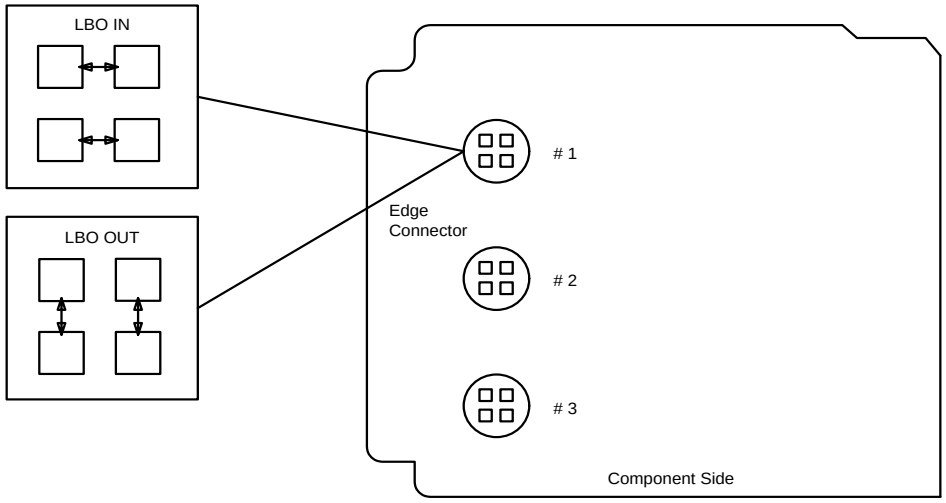
- STS path parameters derived from B3 coding violations
- DS3 path parameters derived from P-bit coding violations
- DS3 path parameters derived from frame and multiframe (F&M) bit errors
- DS3 line errors based on B3ZS violations
- DS3 P-bit and F&M bit performance monitoring for both directions of transmission
- C-bit parity and Far End Block Errors (FEBE) option performance monitoring for both directions of transmission.

Power Circuitry

The BBG11B 3DS3 circuit pack receives two sources of –48 volts that are in turn diode ORed, fused, and filtered before conversion to +5 volts to power the rest of the circuit pack. A failure of the fuse or converter causes the red FAULT LED to light.

BBG11B 3DS3 Hardware Settings

The location of the BBG11B 3DS3 circuit pack LBO jumpers is shown in Figure 7-15. The 3DS3 LBO settings are shown in the table.



3DS3 LBO Settings

Cable Length (Ft)			LBO Setting
734A Cable	Mini-Coax KS-19224	735A Cable	
0 to 225 >225 to 450	0 to 75 >75 to 150	0 to 125 >125 to 250	LBO IN LBO OUT

Figure 7-15. 3DS3 Line Build-Out Jumpers

BBG11B 3DS3 Quick Reference Summary

Transmit Functions

The 3DS3 circuit pack transmit functions are as follows:

- Receives three B3ZS encoded DS3 signals from a DSX-3
- Recovers three DS3 clocks and NRZ data
- Optionally checks and/or corrects P-bit parity errors
- Synchronizes the data signals to STS-1 signal rate
- Inserts STS-1 path overhead
- Provides three STS-1 signals to the TSI circuit packs.

Receive Functions

The following receive functions are performed by the BBG11B 3DS3 circuit pack:

- Desynchronizes the incoming STS-1 signals
- Terminates the STS-1 paths
- Optionally checks and/or corrects P-bit parity errors
- B3ZS encodes the outgoing DS3 signals
- Pre-equalizes the DS3 signals (with LBO) and transmits them to the DSX-3.

Control Functions

The major control functions are as follows:

- Protection switching for TSI and 3DS3 circuit packs
- STS-1 path overhead processing
- Internal fault detection
- Inventory information (*CLEI* code, date of manufacture, etc.).

Maintenance Signal Functions

The major maintenance signal functions are as follows:

- Detects STS-1 path AIS coming from the fiber
- Detects STS-1 path unequipped signal coming from the fiber
- Inserts DS3 AIS toward the fiber and DSX-3
- Detects DS3 AIS coming from the fiber
- Detects DS3 OOF coming from the fiber
- Detects DS3 B3ZS violation threshold crossings from the DSX-3
- Inserts and detects STS-1 path yellow signal to/from the fiber
- Inserts and detects STS-1 path trace
- Detects DS3 line failure (LOS and BER).

BBG12 3STS1E Circuit Pack Description

Purpose of Circuit

The BBG12 3STS1E circuit pack provides bidirectional transport of up to three EC-1 signals through the DDM-2000 OC-12 Multiplexer.

BBG12 3STS1E Faceplate Indicators

The BBG12 3STS1E circuit pack faceplate indicators are shown in Figure 7-16. The red FAULT LED is lit by the SYSCTL on detection of the BBG12 3STS1E circuit pack failure or by the loss of the circuit pack +5 V DC. In the event of an incoming signal failure, this LED will flash on and off. The green ACTIVE LED lights when the circuit pack is active (carrying service).

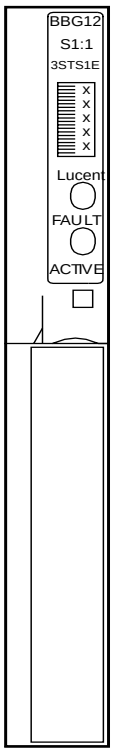


Figure 7-16. BBG12 3STS1E Circuit Pack

General Description of Operation

The BBG12 3STS1E circuit pack provides bidirectional transport of three EC-1 signals through the DDM-2000 OC-12 Multiplexer. The 3STS1E circuit pack performs maintenance and provisioning functions associated with the STS-1 and EC-1 signals. The 3STS1E circuit pack interfaces to the TSI circuit pack at the STS-1 rate, to the STSX-1, and to the SYSCTL, and it receives timing signals from the TSI circuit pack.

Detailed Description of Operation

Transmission Circuitry

Transmit Direction. Figure 7-17 provides an overall block diagram of the BBG12 3STS1E circuit pack. The transmit direction is the direction towards the fiber and the receive direction refers to the direction towards the STSX-1. In the transmit direction, the BBG12 3STS1E receives up to three incoming B3ZS encoded EC-1 signals from the STSX-1 cross-connection panel. A closed protection relay contact routes each EC-1 signal to a circuit that splits the signal and sends one output to the companion (standby) circuit pack and the other to its own receiver. The BBG12 3STS1E receiver performs equalization and clock recovery, B3ZS decoding, and optional automatic AIS insertion. It performs pointer processing on the input data stream and outputs three corresponding data streams, time-aligned with a single frame signal, to the TSI circuit packs.

Receive Direction. The BBG12 3STS1E receives two STS-1 data signal inputs for each of the three EC-1 channels: one from the working TSI circuit pack and one from the standby TSI circuit pack. A jumper allows the user to insert or remove a LBO network (225 ft. of 734A-type cable equivalent) to provide the required signal level and shape at the STSX-1 cross-connection panel.

Control Circuitry

The BBG12 3STS1E circuit pack interfaces with the SYSCTL circuit pack via the intra-shelf control bus. The BBG12 3STS1E circuit pack provides maintenance elements for reporting the status of the circuit pack, status of the incoming STS-1 and EC-1 signals, as well as the circuit pack inventory information (*CLEI* code, date of manufacture, etc.). These maintenance elements are used by the SYSCTL for fault detection and isolation. Conversely, the BBG12 3STS1E responds to control signals from the SYSCTL (such as active and fault LED controls).

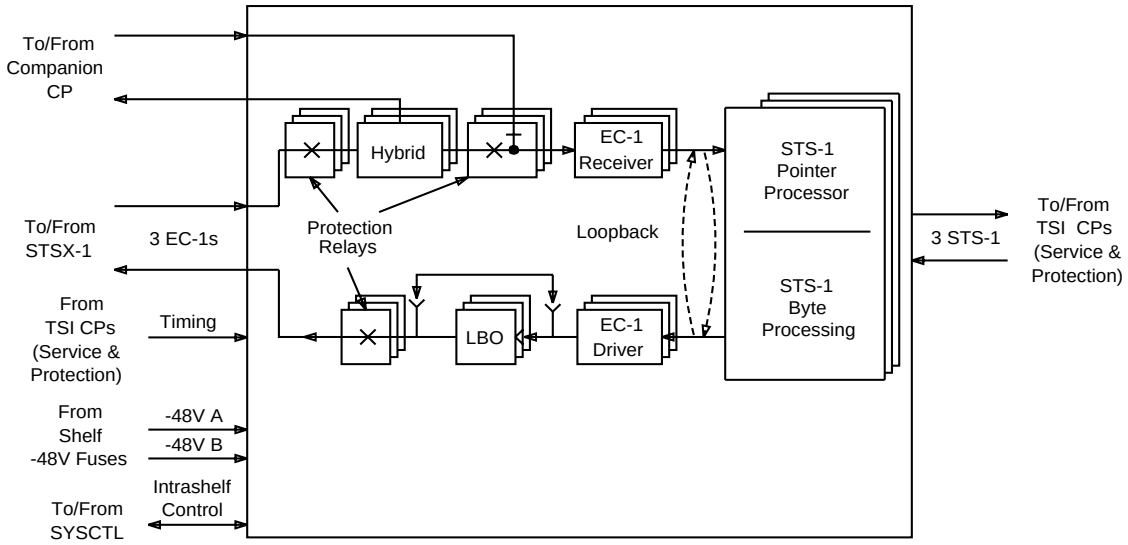


Figure 7-17. BBG12 3STS1E Circuit Pack Block Diagram

Timing Circuitry

The BBG12 3STS1E circuit pack derives its timing information from the recovered clock of the incoming EC-1 signals. In the transmit direction, a 51.84 MHz clock is recovered from the incoming EC-1 signal and is used to recover EC-1 data. In the receive direction, the 3STS1E circuit pack receives its timing from the working and standby TSI circuit packs. The 3STS1E circuit pack selects between the supplied timing signals as requested by the SYSCTL circuit pack via the intra-shelf control bus.

Protection Circuitry

Optional 1x1 nonrevertive BBG12 3STS1E circuit pack protection is provided. Switch points for the STS-1 side of the BBG12 3STS1E are located on the TSI circuit packs. Switch points for the EC-1 side are implemented with relays on the 3STS1E circuit pack. To ensure that the relays can be operated when the circuit pack fails, the relay is controlled by the SYSCTL via the control interfaces. Also, if power to the board is lost, the relay switches autonomously to the standby state. When a new board is inserted, it defaults to the standby state until provisioned active by the SYSCTL.

On the BBG12 3STS1E side, the EC-1 inputs from an STSX-1 cross-connection panel are sent to both the active and standby BBG12 3STS1E circuit packs. Only the active unit selects the EC-1 input. The SYSCTL circuit pack supervises the state of the active and standby units so that the relay state of each is always the inverse of the other. The hybrid on the active unit splits the EC-1 input signals and sends them to the standby unit and to its own receiver. To implement a protection switch on the EC-1 side, the SYSCTL switches the relays on each unit to their opposite state.

When a BBG12 3STS1E is removed, shorting contacts on the backplane connector operate so that the EC-1 input signal from its companion unit is returned for proper termination.

Fault Detection Circuitry

Monitoring and Testing. The BBG12 3STS1E circuit pack has in-service and out-of-service built-in test capability. In-service testing is continuous, and errors are reported when they occur to the SYSCTL via the intra-shelf control bus. An out-of-service test is performed whenever the BBG12 3STS1E circuit pack is inserted or recovers from a transient failure.

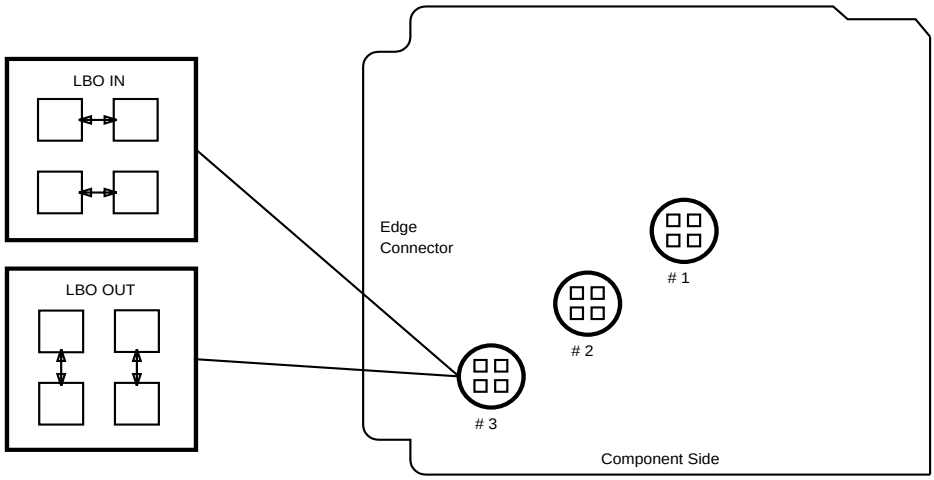
Loopbacks. Two loopbacks (terminal and facility loopbacks) are provided on the BBG12 3STS1E circuit pack. The terminal loopback (STS-1 loopback) loops the incoming STS-1 signal back toward the TSI circuit pack. The facility loopback (STSX-1 loopback) loops the incoming EC-1 signal back toward the STSX-1 cross-connection panel.

Power Circuitry

The BBG12 3STS1E circuit pack receives two sources of –48 volts that are in turn diode ORed, fused, and filtered before conversion to +5 volts to power the rest of the circuit pack. A failure of the fuse or converter causes the red FAULT LED to light.

BBG12 3STS1E Hardware Settings

The location of the BBG12 3STS1E circuit pack LBO jumpers is shown in Figure 7-18. The 3STS1E LBO settings are shown in the table.



3STS1E LBO Settings

Cable Length (Ft)			LBO Setting
734A Cable	Mini-Coax KS-19224	735A Cable	
0 to 225	0 to 75	0 to 125	LBO IN
>225 to 450	>75 to 150	>125 to 250	LBO OUT

Figure 7-18. 3STS1E Line Build-Out Jumpers

BBG12 3STS1E Quick Reference Summary

Transmit Functions

The 3STS1E circuit pack transmit functions are as follows:

- Receives three B3ZS-encoded EC-1 signals from an STSX-1
- Recovers three STS-1 clocks from three incoming data streams
- B3ZS decodes and descrambles three incoming data streams
- Frame synchronizes the incoming EC-1 signal using the STS-1 pointer processor
- Provides three STS-1 signals to the TSI circuit packs.

Receive Functions

The following receive functions are performed by the BBG12 3STS1E circuit pack:

- Receives three incoming STS-1 signals from the TSI circuit pack
- B3ZS-encodes and scrambles data, converts data to bipolar format, and sends it to the STSX-1
- Pre-equalizes the EC-1 signals (with line build-out) and transmits them to the STSX-1.

Control Functions

The major control functions are as follows:

- Protection switching for TSI and 3STS1E circuit packs
- STS-1 path overhead processing
- Internal fault detection
- Inventory information (*CLEI* code, date of manufacture, etc.).

Maintenance Signal Functions

The major maintenance signal functions are as follows:

- Detects STS-1 path AIS coming from the fiber
- Inserts STS-1 path AIS toward the fiber and STSX-1
- Detects EC-1 line failures (LOS, LOF, AIS, and BER)
- Detects EC-1 line signal degrade BER.

BCP3 TSI FLEX Circuit Pack Description

Purpose of Circuit

The BCP3 time slot interchange flexible (TSI FLEX) circuit pack provides a programmable TSI interface between the main-b circuit packs and the function units circuit packs and distributes timing from the TGS circuit packs to the transmission circuit packs.

BCP3 Faceplate Indicators

The BCP3 circuit pack faceplate indicators are shown in Figure 7-19. The red FAULT LED lights on detection of circuit pack failure or by loss of circuit pack +5 V DC. The green ACTIVE LED lights indicating that the BCP3 circuit pack is active (carrying service).

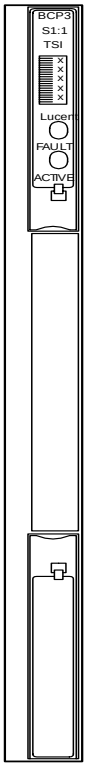


Figure 7-19. BCP3 Circuit Pack

General Description of Operation

The BCP3 provides the 51.84 MHz clock and the 8-kHz frame pulse to all main-b and function units service and protection circuit packs. In the receive direction, the BCP3 receives twelve 51.84 Mb/s STS-1s from an active main-b circuit pack and groups them into sets of three STS-1s. Each set of three STS-1s is connected to both active and standby function unit circuit packs. In the transmit direction, the BCP3 accepts twelve STS-1s from active function unit circuit packs and transfers them to the main-b-1 and main-b-2 circuit packs. The BCP3 also interfaces to the SYSCTL and receives timing signals from the TGS circuit packs.

Cross-connections can be made from main-to-main or main to any function unit.

Detailed Description of Operation

Transmission Circuitry

Figure 7-20 provides an overall block diagram of the BCP3 circuit pack.

Transmit Direction. In the transmit direction, under control of the SYSCTL circuit pack, the BCP3 selects 12 STS-1 signals from the function unit slots and sends them to the main-b slots.

Receive Direction. Under control of the SYSCTL circuit pack, the BCP3 selects 12 STS-1 signals from the main-b slots. The 12 STS-1 signals are transmitted to the function unit slots.

Clock and Frame SYNC Distribution

Each BCP3 circuit pack receives a 51.84-MHz clock and an associated 8-kHz frame pulse from each of the active and standby TGS circuit packs. Each BCP3 provides balanced clocks at 51.84 MHz and balanced frame sync at 8 kHz to the main-b-1 and main-b-2 circuit packs, and the four active and four standby function unit circuit packs. It also provides a pair of clock and frame sync to the other BCP3 circuit pack. The BCP3, under control of the SYSCTL circuit pack, normally selects signals from the active TGS. If a failure of the clock or frame is detected, the BCP3 can automatically switch to the standby TGS circuit pack. The SYSCTL can inhibit autonomous clock selection.

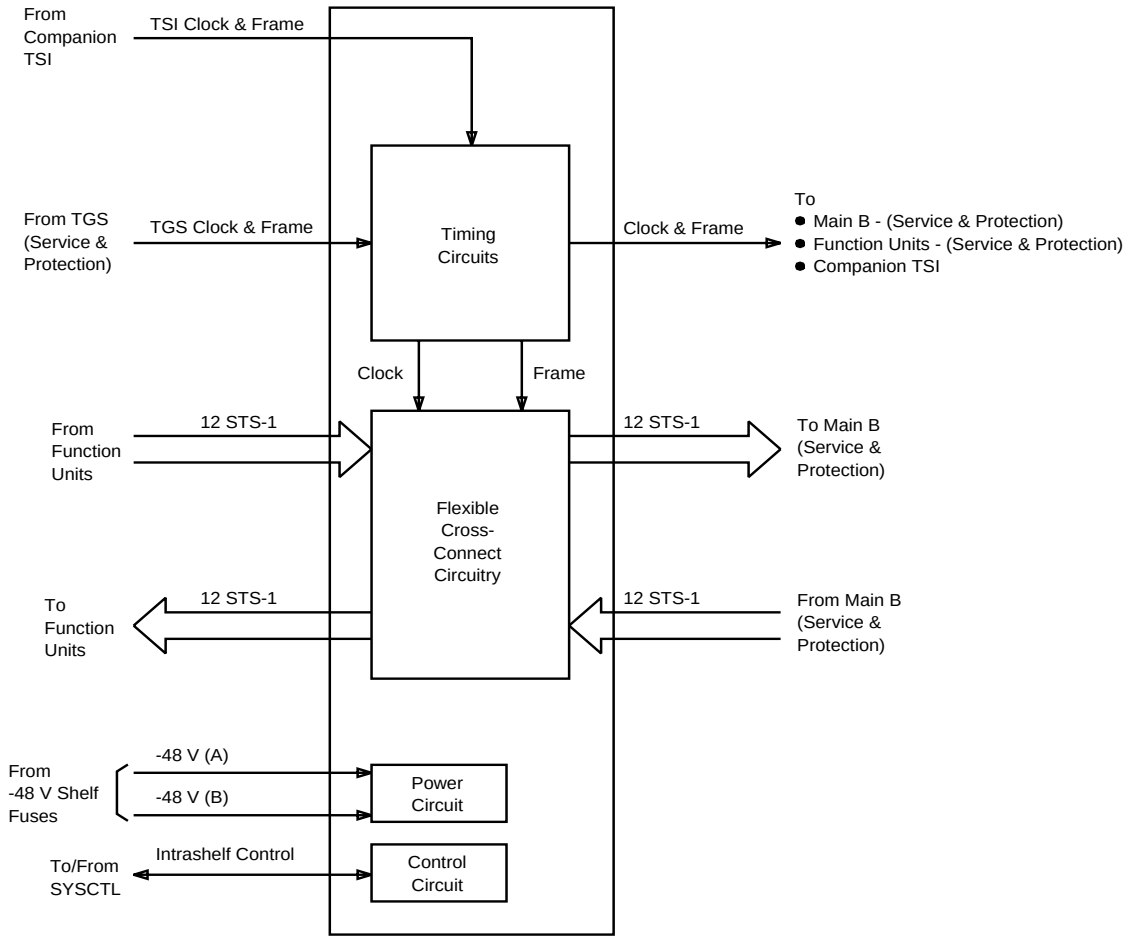


Figure 7-20. BCP3 Circuit Pack Block Diagram

Maintenance Features and Modes

The BCP3 circuit pack communicates with the SYSCTL circuit pack via a control interface.

Transmit Direction. The BCP3 receives 12 sets of STS-1 data signals, one each from the active and standby function unit circuit packs. One set is selected by SYSCTL request.

Receive Direction. The BCP3 receives two sets of 12 STS-1 data signals, one each from the active and standby main-b circuit packs. One set is selected by SYSCTL provisioning.

Performance Monitoring. The BCP3 circuit pack monitors the STS path bit interleaved parity (BIP-8) on all selected inputs from the main-b and function unit circuit packs.

Other Functions: ■Circuit pack insertion and removal detection

- FAULT LED (red) control (via control interface)
- ACTIVE LED (green) control (via control interface)
- +5 volt power module failure
- Circuit pack version and type recognition (EEPROM via control interface).

Power Circuitry

The BCP3 receives –48 volts which are diode ORed, fused, and filtered prior to conversion to the +5 volt source for the circuit pack. A failure of the fuse or converter causes the red FAULT LED to light.

BCP3 Quick Reference Summary

Interface Functions

STS-1 signal interface functions performed by the BCP3 are as follows:

- Transmission of selected STS-1 signals from function units to the main-b circuit packs
- Transmission of selected STS-1 signals from main-b to the function unit circuit packs.

Timing signal interface functions are as follows:

- Clock and frame selection from active and standby TGS circuit packs
- Clock and frame distribution to main-b circuit packs
- Clock and frame distribution to function units
- Clock and frame distribution to companion BCP3 circuit pack.

Control Functions

- Protection switching for all protected circuit packs
- Inventory information (*CLEI* code, date of manufacture, etc.)
- STS-1 and STS-3c path protection switching.

Maintenance Functions

Maintenance functions provided by the BCP3 circuit pack are as follows:

- Circuit pack fault detection and reporting
- STS path BIP-8 performance monitoring
- Insertion of STS path AIS
- Insertion and detection of path unequipped signal
- Detection of STS-1 and STS-3c path fail BER (10^{-3})
- Detection of STS-1 and STS-3c path BER signal degrade (10^{-5} to 10^{-9}).

21D/21D-U OLIU Circuit Pack Description

Purpose of Circuit

The 21D/21D-U OLIU circuit pack is used to interconnect colocated OC-3 and OC-12 shelves at the OC-3 rate. It performs the optical/electrical conversion between the optical interconnect signal level 3 (IS-3) and STS-3 signals. It also does the multiplexing between STS-3 and three STS-1 signals and provides SONET transport overhead access.

21D and 21D-U OLIU Faceplate Indicators

The 21D/21D-U OLIU circuit pack faceplate indicators are shown in Figure 7-21. The red FAULT LED lights on detection of circuit pack hardware failure or by loss of circuit pack +5 V DC. In the event of an incoming signal failure, this LED will flash ON and OFF. The green ACTIVE LED lights when the circuit pack is active (carrying service).

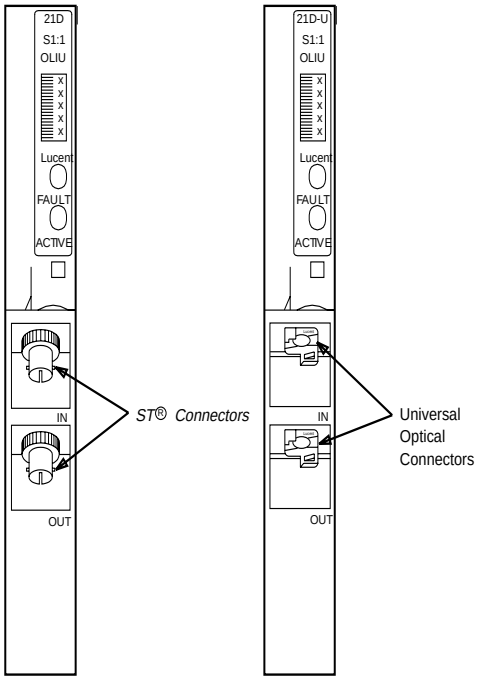


Figure 7-21. 21D and 21D-U OLIU Circuit Packs

General Description of Operation

The 21D/21D-U OLIU circuit pack multiplexes three STS-1 signals to an STS-3, inserts the SONET transport overhead bytes (line and section), and scrambles the resulting signal. This STS-3 signal drives an LED transmitter to create the IS-3 output.

The received IS-3 signal is converted back to an electrical STS-3. This STS-3 is descrambled and demultiplexed to three STS-1 signals, and transport overhead is accessed. Some of the overhead (for example, section datacom channel) is passed via serial data links to the control packs, while other bytes (for example framing, parity check) are processed on-board. Finally, the STS-1 signals run through a pointer-processing step (interpretation and regeneration) to guarantee frame alignment to the local system clock before they are sent to the TSI slots. Fiber access is via a pair of *ST* (21D) or universal (21D-U) lightguide cable connectors from the 21D/21D-U OLIU faceplate. The 21D/21D-U OLIU operates ***only*** on multimode cable.

Detailed Description of Operation

Figure 7-22 is an overall block diagram of the 21D/21D-U OLIU circuit pack.

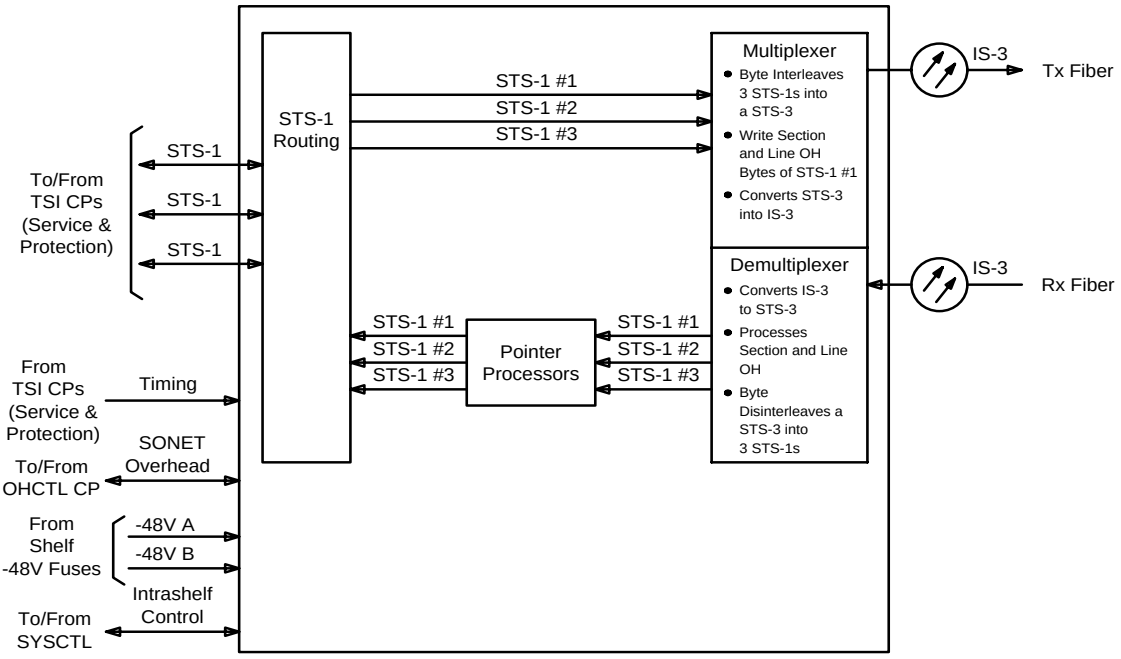


Figure 7-22. 21D/21D-U OLIU Circuit Pack Block Diagram

Transmission Circuitry

Transmit Direction. The 21D/21D-U OLIU circuitry selects the three STS-1 signals from the TSI, adds SONET transport overhead, then byte-interleaves and scrambles the signal in a frame synchronous scrambler. The output from the multiplexer is an STS-3 signal that is used to amplitude modulate the LED transmitter, converting the electrical signal to an NRZ-encoded IS-3 optical signal.

Receive Direction. In the receive direction, the optical receiver converts the light pulses from an IS-3 optical signal to equivalent electrical pulses. The received signal may be either NRZ- or RZ-encoded. The output from the optical receiver goes into a timing recovery device. The device recovers received clock (155.520 MHz) and uses it to retime the received data, providing a retimed STS-3 signal. The demultiplexer circuit accepts the STS-3 bit stream, frames on the incoming signal, descrambles it, demultiplexes it into three STS-1 signals, and processes IS-3 transport overhead. The overhead information is sent to the OHCTL circuit pack via the intra-shelf control bus and the transport overhead channel interface.

The STS-1 outputs from the demultiplexer are sent to the pointer processor that performs pointer interpretation and generation on each received STS-1, using the local timing signals. The output of the pointer processor is three STS-1 signals, frame synchronous to each other.

Control Circuitry

The 21D/21D-U OLIU circuit pack interfaces with the SYSCTL and OHCTL circuit packs.

The 21D/21D-U OLIU provides maintenance elements for reporting the status of the circuit pack, status of the incoming STS-1 and IS-3 signals, as well as inventory information (*CLEI* code, date of manufacture, etc.). These maintenance elements are used by the SYSCTL for fault detection and isolation. Conversely, the 21D/21D-U OLIU responds to control signals from the SYSCTL, such as LED operation and protection switching.

The 21D/21D-U OLIU accesses the IS-3 transport overhead and routes it via the transport overhead channel interface to the OHCTL.

Timing Circuitry

Each TSI circuit pack sends timing signals to each 21D/21D-U OLIU circuit pack. The 21D/21D-U OLIU monitors activity on both timing inputs. It normally selects the signals from the active TSI as requested by the SYSCTL. If there is a failure of the active input, the SYSCTL may command the 21D/21D-U OLIU to select the OLIU input.

Protection Circuitry

Optional 1+1 nonrevertive unidirectional line protection switching compliant with SONET specifications is provided. The 21D/21D-U OLIU is protection switched by the SYSCTL in response to an external command, incoming signal failure, or internal equipment fault. The 21D/21D-U OLIU circuit pack is protection switched with the IS-3 line.

The 21D/21D-U OLIU provides selectors for STS-1 and timing signals from the TSI circuit packs. The 21D/21D-U OLIU monitors these inputs and selects one as directed by SYSCTL.

Fault Detection Circuitry

The 21D/21D-U OLIU circuit pack has in-service and out-of-service built-in test capability. An out-of-service test is performed whenever the 21D/21D-U OLIU resets or is commanded to reset by the SYSCTL through the serial interface. In-service testing is continuous and errors are reported when they occur to the SYSCTL via the intra-shelf control bus. An out-of-service test is performed whenever the 21D/21D-U OLIU circuit pack is inserted or recovers from a transient failure.

Performance Monitoring

The 21D/21D-U OLIU circuit pack provides PM circuitry for the following performance parameters:

- Section severely errored frame seconds (SEFS) count
- Line parameters based on B2 coding violations.

Power Circuitry

Power for the 21D/21D-U OLIU circuit pack is provided by a DC-to-DC converter located on the 21D/21D-U OLIU circuit pack. The converter supplies +5 volts and –5.2 volts. Both A and B –48 volt backplane busses supply power to the converter through diode ORed circuit pack-mounted power select circuits and circuit pack-mounted fuses. A failure of the fuse or converter causes the red FAULT LED to light.

21D/21D-U OLIU Quick Reference Summary

Transmit Functions

Major transmit functions of the 21D/21D-U OLIU circuit pack are as follows:

- Selects STS-1 inputs from TSI circuit packs
- Adds SONET transport overhead
- Byte-interleaves and scrambles the three selected STS-1 or optional STS-3c signals to produce an STS-3 or STS-3c signal
- Converts the STS-3 or STS-3c signal to an IS-3 or IS-3c optical signal for transmission over the optical fiber.

Receive Functions

The following are major receive functions of the 21D/21D-U OLIU circuit pack:

- Receives an optical IS-3 or IS-3c signal and converts it to an electrical STS-3 or STS-3c signal
- Extracts STS-3 or STS-3c clock and retimes the received data
- Demultiplexes the STS-3 or STS-3c signal into three STS-1 signals
- Extracts transport overhead
- Processes the STS-1 or STS-3c pointers and frame-synchronizes the STS-1 signals
- Sends the three STS-1 signals to both TSIs.

Control Functions

The major control functions are as follows:

- Protection switching for TSI circuit packs
- Transport overhead processing
- Inventory information (*CLEI* code, date of manufacture, etc.).

Maintenance Signal Functions

The major maintenance signal functions are as follows:

- Inserts and detects STS-1 path AIS
- Inserts STS-1 path unequipped signal
- Inserts and detects IS-3 line AIS
- Inserts and detects far-end receive line failure (FERF)
- Detects IS-3 line failures (LOS, LOF, AIS, and BER)
- Detects IS-3 line signal degrade BER.

21G/21G-U/21G2-U OLIU Circuit Pack Description

Purpose of Circuit

The 21G/21G-U/21G2-U OLIU circuit pack performs the optical/electrical conversion between the OC-3 and STS-3 signals, multiplexing/demultiplexing between STS-3 and three STS-1 signals and SONET transport overhead access. The 21G/21G-U/21G2-U can be used in either the main or function unit slots in an OC-3 shelf, or the function unit slots only in an OC-12. In the OC-3 shelf, the 21G/21G-U/21G2-U OLIU circuit pack also provides routing of the STS-1s between the OC-3 interface and other main and function unit slots in the shelf and will support the STS-1 add/drop feature. In the OC-12 shelf, the routing function is performed in the TSI circuit pack.

21G/21G-U/21G2-U OLIU Faceplate Indicators

The 21G2-U OLIU is the same as the 21G/21G-U OLIUs but has improved receiver overload sensitivity, eliminating the need for a Hi/Low power switch for loopback testing. The 21G2-U can be used in place of the 21G/21G-U in all applications.

The 21G/21G-U/21G2-U OLIU circuit pack faceplate indicators are shown in Figure 7-23. The red FAULT LED lights on detection of circuit pack hardware failure. In the event of an incoming signal failure, this LED will flash ON and OFF. The green ACTIVE LED lights when the circuit pack is active (carrying service).

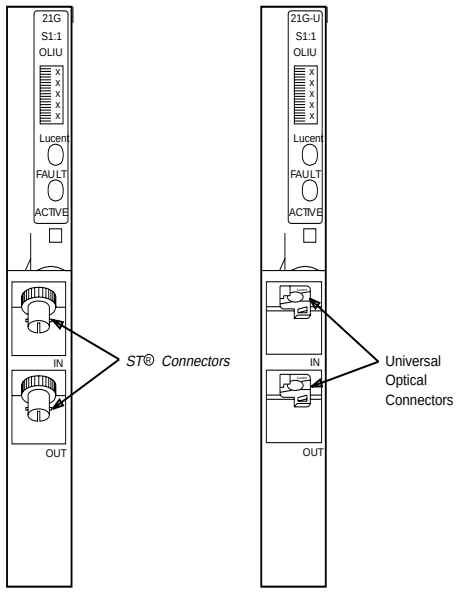


Figure 7-23. 21G and 21G-U/21G2-U OLIU Circuit Packs

General Description of Operation

The 21G/21G-U/21G2-U OLIU multiplexes three STS-1 signals to an STS-3, inserts the SONET transport overhead bytes (line and section), and scrambles the resulting signal. This STS-3 signal drives the laser transmitter to create the OC-3 output.

The received OC-3 signal is converted back to an electrical STS-3. This STS-3 is descrambled and demultiplexed to three STS-1 signals, and transport overhead is accessed. Some of the overhead (for example, section datacom channel) is passed via serial data links to the control packs, while other bytes (for example framing, parity check) are processed on-board. The STS-1 signals go through a pointer processor to guarantee frame alignment to the local system clock before being routed to the other main and function unit slots.

The 21G/21G-U/21G2-U OLIU provides timing signals to and receives timing signals from the TGS circuit packs.

Fiber access for the 21G OLIU is via a pair of *ST* lightguide cable connectors from the OLIU faceplate. A faceplate-mounted universal optical connector allows the 21G-U/ 21G2-U OLIU to accept fiber terminated with *ST*, SC, or FC connectors. Various combinations of buildouts and connectors are also available. See Section 10, "Technical Specifications" for a list of universal buildout attenuators. The 21G/21G-U/ 21G2-U OLIU photonics comply with SONET long-reach specifications. While single-mode fiber is suggested for optimum performance, multimode facilities are also supported.

Detailed Description of Operation

Figure 7-24 is an overall block diagram of the 21G/21G-U/21G2-U OLIU circuit pack.

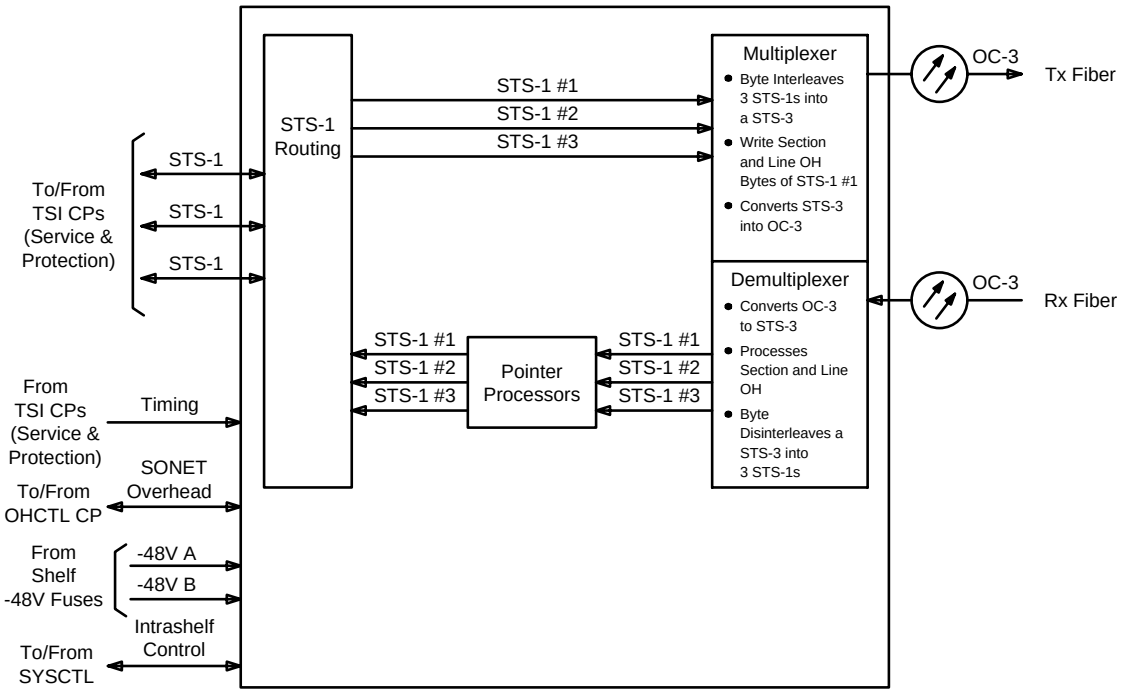


Figure 7-24. 21G/21G-U/21G2-U OLIU Circuit Pack Block Diagram

Transmission Circuitry

Transmit Direction. The STS-1 router selects three of the STS-1 signals received from other main and function unit slots, or from TSI slots in the OC-12 shelf, and sends them to the multiplexer. The multiplexer circuitry takes the three STS-1 signals from the output of the router, adds SONET transport overhead, then byte-interleaves and scrambles the signal in a frame synchronous scrambler. The output from the multiplexer is in the SONET STS-3 format and is used to amplitude modulate the laser transmitter, which converts the electrical signal to an NRZ-encoded SONET compatible OC-3 optical signal.

Receive Direction. In the receive direction, the optical receiver converts the light pulses from an NRZ-encoded OC-3 signal to equivalent electrical pulses. The output from the optical receiver goes into a timing recovery device. The device recovers received clock (155.520 MHz) and uses it to retime the received data. The demultiplexer circuit accepts the retimed STS-3 bit stream, frames on the incoming signal, descrambles it, demultiplexes it into three STS-1 signals, and processes SONET transport overhead. The overhead information is sent to the SYSCTL pack via the intra-shelf control bus and the transport overhead channel interface.

The STS-1 outputs from the demultiplexer are sent to the pointer processor which performs pointer interpretation and generation on each received STS-1 using the local timing signals. The output of the pointer processor is three STS-1 signals, frame synchronous to each other. The STS-1 router sends each of the three STS-1 signals to the appropriate main or function unit in the OC-3 shelf, or TSI slots in the OC-12 shelf.

Control Circuitry

The 21G/21G-U/21G2-U OLIU circuit pack interfaces with the system controller (SYSCTL) and with the overhead controller (OHCTL) circuit packs.

The 21G/21G-U/21G2-U OLIU provides maintenance elements for reporting the status of the circuit pack, status of the incoming optical and electrical signals, as well as inventory information (*CLEI* code, date of manufacture, etc.). These maintenance elements are used by the SYSCTL for fault detection and isolation. Conversely, the OLIU responds to control signals from the SYSCTL such as STS-1 routing, protection switching, and LED control commands.

The 21G/21G-U/21G2-U OLIU accesses the SONET transport overhead and routes it via the transport overhead channel interface to the AUXCTL slot and/or to the SYSCTL. The transport overhead is routed from the main slots to both the AUXCTL and SYSCTL slots and from the function unit slots to the AUXCTL slot.

Timing Circuitry

Each TGS circuit pack sends timing signals to each OLIU. Each OLIU monitors the timing inputs from both TGS circuit packs. The OLIU normally selects the timing signals from the active TGS circuit pack. Each OLIU provides timing signals derived from the incoming optical signal to both TGS circuit packs for line (formerly loop) timing and DS1 timing outputs (BITS).

Protection Circuitry

Optional 1+1 nonrevertive unidirectional line protection switching compliant with SONET specifications is provided. The 21G/21G-U/21G2-U OLIU is protection switched by the SYSCTL in response to an external command, incoming signal failure, or internal equipment fault. The 21G/21G-U/21G2-U OLIU circuit pack is protection switched with the optical line.

The 21G/21G-U/21G2-U OLIU interfaces with STS-1 signals from the circuit packs in the main and function unit slots in an OC-3 shelf, or TSI slots in an OC-12 shelf, and selects the signals from the service or protection slot of each pair as directed by the SYSCTL.

The 21G/21G-U/21G2-U OLIU provides selectors for timing signals from the TGS circuit packs, monitors these inputs, and autonomously selects either one. The SYSCTL can inhibit autonomous selection and make its own selection.

Fault Detection Circuitry

The 21G/21G-U/21G2-U OLIU circuit pack has in-service and out-of-service built-in test capability. In-service testing is continuous and errors are reported when they occur to the SYSCTL via the intra-shelf control bus. An out-of-service test is performed whenever the 21G/21G-U/21G2-U OLIU circuit pack is inserted or recovers from a transient failure.

Performance Monitoring

The 21G/21G-U/21G2-U OLIU provides PM circuitry for the following performance parameters:

- Laser bias current threshold (21G and 21G-U only)
- Transmit optical power threshold (21G and 21G-U only)
- SEFS
- Line parameters derived from B2 coding violations.

Power Circuitry

Power for the 21G/21G-U OLIU circuit pack is provided by two DC-to-DC converters located on the 21G/21G-U OLIU circuit pack. One converter supplies +5 volts and the other supplies –5.2 volts. Both A and B –48 volt backplane busses supply power to the converters through diode ORed circuit pack-mounted power select circuits and a circuit pack-mounted fuse. Failure of the fuse or either converter causes the red FAULT LED to light.

21G/21G-U OLIU Hardware Settings

The location of the 21G/21G-U OLIU circuit pack optical power output level switch is shown in Figure 7-25. This switch allows the 21G/21G-U OLIU to be looped back without an external optical attenuator cable. The optical power output level switch in the LOW POWER position attenuates the transmit optical power by 5 dB.

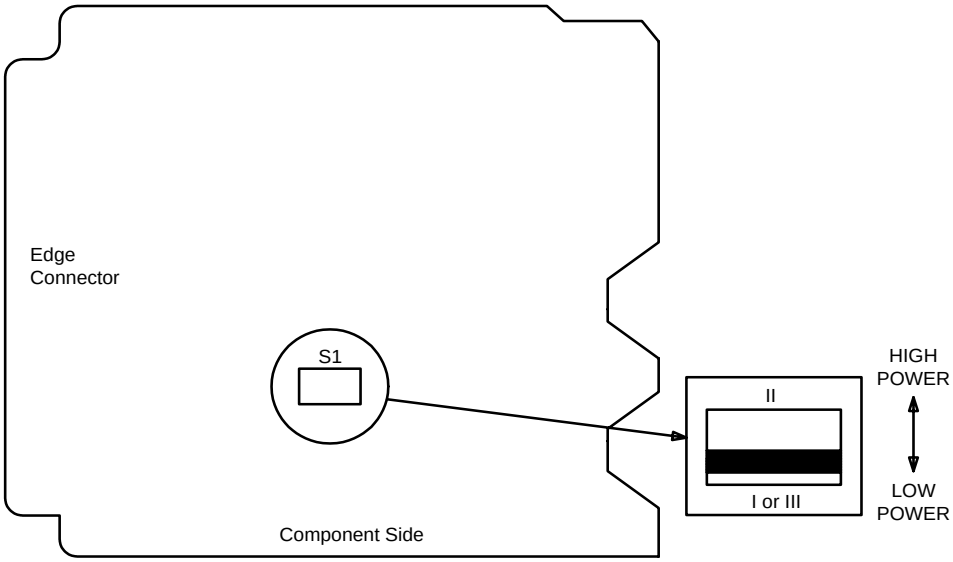


Figure 7-25. 21G/21G-U OLIU Output Level Switch

NOTE: The 21G2-U OLIU does not have a High/Low transmitter power switch due to improved overload sensitivity of the receiver used on the 21G2-U. Refer to Table 10-5 for OLIU Link Budget information.

21G/21G-U/21G2-U OLIU Quick Reference Summary

Transmit Functions

The following are the major transmit functions of the 21G/21G-U/21G2-U OLIU circuit pack:

- Selects STS-1 inputs from MXRVO, DS3, STS1E, or other OLIU circuit packs
- Provides STS-1 signal cross-connections
- Adds SONET transport overhead
- Byte-interleaves and scrambles the three selected STS-1 signals to an STS-3 or STS-3c signal
- Converts the STS-3 or STS-3c electrical signal to an optical signal and transmits it over the fiber
- Monitors laser bias and output power (21G and 21G-U only).

Receive Functions

The following are major receive functions of the 21G/21G-U/21G2-U OLIU circuit pack:

- Receives an optical OC-3 or OC-3c signal and converts it to an electrical STS-3 or STS-3c signal
- Extracts STS-3 clock and retimes the received data
- Demultiplexes the STS-3 or STS-3c signal into three STS-1 signals
- Extracts transport overhead
- Processes the STS-1 or STS-3c pointers and frame-synchronizes the STS-1 signals
- Provides STS-1 signal cross-connections
- Processes the received clock and provides a reference clock to the TGS circuit packs (OC-3 shelf only).

Control Functions

The following are the major control functions of the 21G/21G-U/21G2-U OLIU circuit pack:

- Switches protection for the optical line and DS3, MXRVO, STS1E, and TGS circuit packs on the OC-3 shelf. On the OC-12 shelf, switches protection for the TSI and TGS circuit packs.
- Processes transport overhead
- Stores inventory information (*CLEI* code, date of manufacture, etc.).

Maintenance Signal Functions

The following are the major maintenance signal functions of the 21G/21G-U/ 21G2-U OLIU circuit pack:

- Inserts and detects STS-1 path AIS
- Inserts and detects SONET line AIS and inserts and detects line far-end-receive failure (FERF)
- Inserts STS-1 path unequipped signal
- Detects OC-3 line failures (LOS, LOF, AIS, and BER)
- Detects STS-1 LOP
- Detects OC-3 line signal degrade BER.

23G/23G-U OLIU Circuit Pack Description

Purpose of Circuit

The 23G/23G-U OLIU circuit pack provides a 1310 nm long reach interface between an optical OC-12 line and 12 STS-1 electrical signals.

23G/23G-U OLIU Faceplate Indicators

The 23G/23G-U OLIU circuit pack faceplate indicators are shown in Figure 7-26. The red FAULT LED lights on detection of circuit pack hardware failure or by loss of circuit pack +5 V, –5.2 V, +15 V, and/or –2.3 V DC. The green ACTIVE LED lights when the circuit pack is active (carrying service).

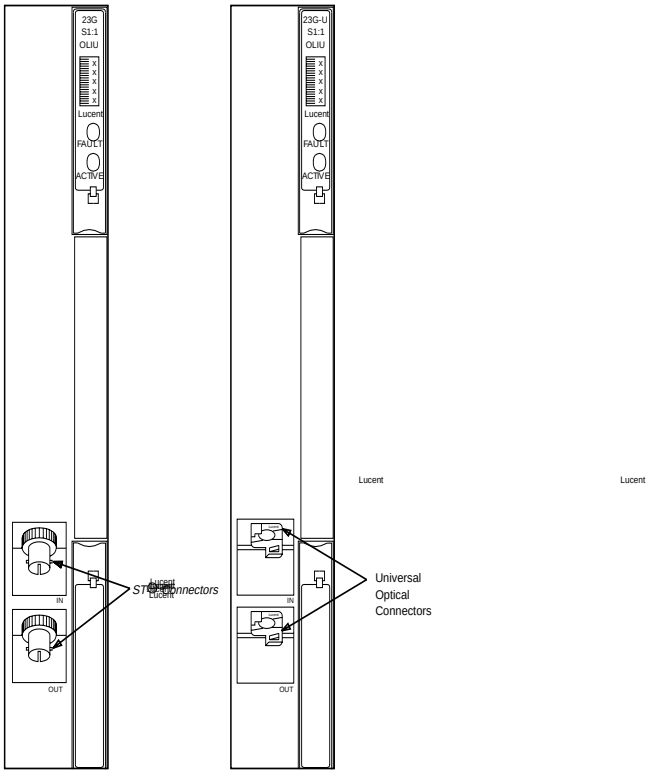


Figure 7-26. 23G and 23G-U OLIU Circuit Packs

General Description of Operation

The 23G/23G-U OLIU circuit pack provides an interface between an OC-12 optical line and 12 STS-1 signals. The 23G/23G-U OLIU provides 24 STS-1 input ports, 12 from service and 12 from protection TSI circuit packs. It selects up to 12 STS-1 inputs, performs pointer processing and frame alignment on each STS-1, inserts transport overhead, and combines and scrambles the 12 STS-1 signals into an STS-12 (622.08 Mb/s) signal. The 23G/23G-U OLIU then performs an electrical-to-optical conversion and outputs an OC-12 optical signal for transmission on an optical fiber.

The 23G/23G-U OLIU receives an optical OC-12 signal and converts it to an electrical signal. It frames on and descrambles the signal, processes the transport overhead, and demultiplexes the STS-12 into 12 STS-1 signals. It performs pointer processing and frame alignment on each STS-1. The 23G/23G-U OLIU outputs 24 STS-1 signals, 12 to service and 12 to protection TSI circuit packs.

The 23G/23G-U OLIU performs maintenance and provisioning functions associated with the STS-1 and OC-12 inputs and outputs. It provides access to the line and section overhead in the STS-12 signal and interfaces to the TSI circuit pack at the STS-1 rate and to the optical line at the OC-12 rate. It interfaces to the SYSCTL and OHCTL and sends recovered timing signals to the TGS circuit packs. The 23G/23G-U OLIU receives its timing signals from the TSI circuit packs.

Fiber access is via a pair of *ST* (23G) or universal (23G-U) lightguide cable connectors from the 23G/23G-U OLIU faceplate. Single-mode fiber is suggested for optimum performance. The 23G/23G-U OLIU photonics comply with SONET long-reach specifications.

For 23G applications requiring external optical attenuators, the faceplate-mounted transmit (OUT) connector is designed to accept a lightguide buildout. Available buildouts are A3010B - 5 dB, A3010D - 10 dB, and A3010F - 15 dB. For 23G-U applications, see Section 10, "Technical Specifications," for a list of universal buildout attenuators.

Detailed Description of Operation

Transmission Circuitry

Transmit Direction. Figure 7-27 is a functional block diagram of the 23G/23G-U OLIU. The 23G/23G-U OLIU receives an STS-1 rate clock and an associated frame pulse from each of the working and standby TSI circuit packs. The 23G/23G-U OLIU, under control of the SYSCTL, normally selects signals from the working TSI. If a failure of the working clock is detected, the 23G/23G-U OLIU can be switched to the standby TSI under SYSCTL control. An STS-12 rate clock is generated from the STS-1 clock and used in creating the STS-12 signal. Under control of the SYSCTL circuit pack, the 23G/23G-U OLIU selects one group of 12 STS-1 signals from either of the 12 active or 12 standby STS-1 inputs. The 23G/23G-U OLIU performs pointer processing and frame alignment, and adds transport overhead to the selected STS-1 signals. The 23G/23G-U OLIU provides access to the transport overhead which is sent to and received from the OHCTL.

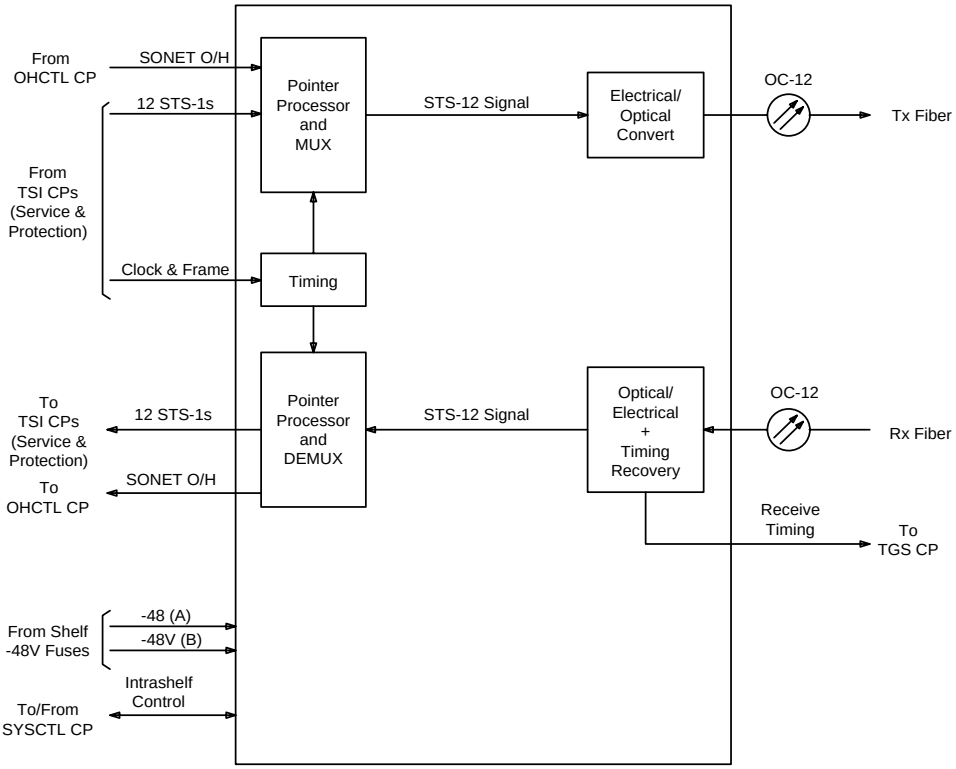


Figure 7-27. 23G/23G-U OLIU Circuit Pack Block Diagram

The STS-1 signals are byte-interleaved and scrambled in a frame synchronous scrambler to produce a SONET format compatible STS-12 signal. The STS-12 signal is used to amplitude modulate a laser transmitter to convert the electrical signal to an NRZ-encoded SONET compatible OC-12 optical signal.

Receive Direction. The 23G/23G-U OLIU circuit pack receives an OC-12 optical signal that is an NRZ-coded SONET compatible signal. An optical receiver converts the optical OC-12 signal to an electrical STS-12 signal. An STS-12 rate clock is recovered and used to retime the data.

The 23G/23G-U OLIU frames on the retimed STS-12 data, demultiplexes it into 12 STS-1 signals, and provides the transport overhead access.

The 23G/23G-U OLIU performs pointer interpretation, frequency justification, and pointer generation on each of the STS-1 signals, using the local clock and frame from the selected TSI circuit pack. The result is 12 STS-1 signals that are frame synchronous with each other and with the local clock and frame sync.

Each STS-1 signal is bridged to the service and protection TSI circuit packs.

The 23G/23G-U OLIU sends a clock derived from the recovered receive clock to the TGS circuit packs for loop timing. The 23G/23G-U OLIU provides transport overhead access in the receive direction.

Control Circuitry

The 23G/23G-U OLIU circuit pack interfaces with the SYSCTL and the OHCTL circuit packs.

Control and Maintenance Functions . The 23G/23G-U OLIU provides maintenance elements for reporting the status of the circuit pack and the incoming STS-1 and OC-12 signals to the SYSCTL. Conversely, the 23G/23G-U OLIU responds to control signals from the SYSCTL.

- SYSCTL: The 23G/23G-U OLIU communicates with the SYSCTL circuit pack via a control interface. The 23G/23G-U OLIU provides maintenance elements for reporting the status of the circuit pack and the incoming STS-1 and OC-12 signals. These maintenance elements are used by the SYSCTL for fault detection and isolation. Conversely, the 23G/23G-U OLIU responds to control signals from the SYSCTL, such as LED and protection switching controls.
- Transport Overhead Channel Interface: The 23G/23G-U OLIU accesses the SONET overhead and routes this data to the OHCTL.

Timing Circuitry

Each TGS circuit pack sends timing signals to the 23G/23G-U OLIU circuit pack via the TSI circuit packs.

The 23G/23G-U OLIU circuit pack sends a clock signal to both TGS circuit packs for loop timing.

Protection Circuitry

The 23G/23G-U OLIU provides STS-1 data path selectors for implementing a 1x1 protection switch between TSI circuit packs. The selectors are controlled by the SYSCTL.

The 23G/23G-U OLIU is protection switched by the SYSCTL in response to fault indications on the 23G/23G-U OLIU, or in response to fault indications on a transmission circuit pack with which it interfaces, or in response to external commands.

Fault Detection Circuitry

The 23G/23G-U OLIU circuit pack has in-service and out-of-service built-in test capability. In-service device testing is continuous, and errors are reported to the SYSCTL when they occur via the intra-shelf control bus. Incoming and outgoing optical power thresholds are also monitored.

There is no electrical loopback in the 23G/23G-U OLIU. All loopbacks are external optical loopbacks which require an attenuator.

Performance Monitoring

The 23G/23G-U OLIU provides PM circuitry for the following maintenance parameters:

- Parity error counts
- Incoming OC-12 OOF counts
- Outgoing OC-12 laser bias current threshold
- Line parameters based on B2 coding violations.

Power Circuitry

The 23G/23G-U OLIU circuit pack uses board-mounted DC-DC power converters that converts –48 V received from the backplane to +5 V, –5.2 V, +15 V, and –2.3 V for use on the circuit pack. The 23G/23G-U OLIU interfaces with both the A and B feeders and provides a "diode-ORed" so that loss of one feeder will not affect the 23G/23G-U OLIU. A fuse element is provided at the –48 V input to the DC-DC converter.

23G/23G-U OLIU Quick Reference Summary

Transmit Functions

The major transmit functions of the 23G/23G-U OLIU circuit pack are as follows:

- Selects 12 STS-1 signals from the TSI circuit packs
- Adds SONET transport overhead
- Byte-interleaves and scrambles the STS-1 signals to produce an STS-12 signal
- Modulates a laser transmitter to produce an OC-12 signal.

Receive Functions

The major receive functions of the 23G/23G-U OLIU circuit pack are as follows:

- Receives an OC-12 optical signal and converts an OC-12 signal to an electrical STS-12 signal
- Extracts STS-12 clock and retimes the received data
- Demultiplexes the STS-12 signal into 12 STS-1 signals
- Extracts and processes the STS-1 transport overhead
- Processes the STS-1 pointer and frame-synchronizes the STS-1 signals
- Processes the receive clock and provides a loop-timing clock to the TGS circuit packs.

Control Functions

Control functions are as follows:

- Protection switching for TSI circuit packs
- Inventory information (*CLEI* code, date of manufacture, etc.).

Maintenance Signal Functions

The 23G/23G-U OLIU major maintenance signal functions are as follows:

- Inserts and detects STS-1 path AIS
- Inserts STS-1 path unequipped signal
- Inserts and detects OC-12 line AIS
- Inserts and detects OC-12 line FERF
- Detects OC-12 line failures (LOS, LOF, AIS, and BER)
- Detects OC-12 line signal degrade BER.

23H/23H-U OLIU Circuit Pack Description

Purpose of Circuit

The 23H/23H-U OLIU circuit pack provides a 1550 nm long reach interface between an optical OC-12 line and 12 STS-1 electrical signals.

23H/23H-U OLIU Faceplate Indicators

The 23H/23H-U OLIU circuit pack faceplate indicators are shown in Figure 7-28. The red FAULT LED lights on detection of circuit pack hardware failure or by loss of circuit pack +5 V, –5.2 V, +15 V, and/or –2.3 V DC. The green ACTIVE LED lights when the circuit pack is active (carrying service).

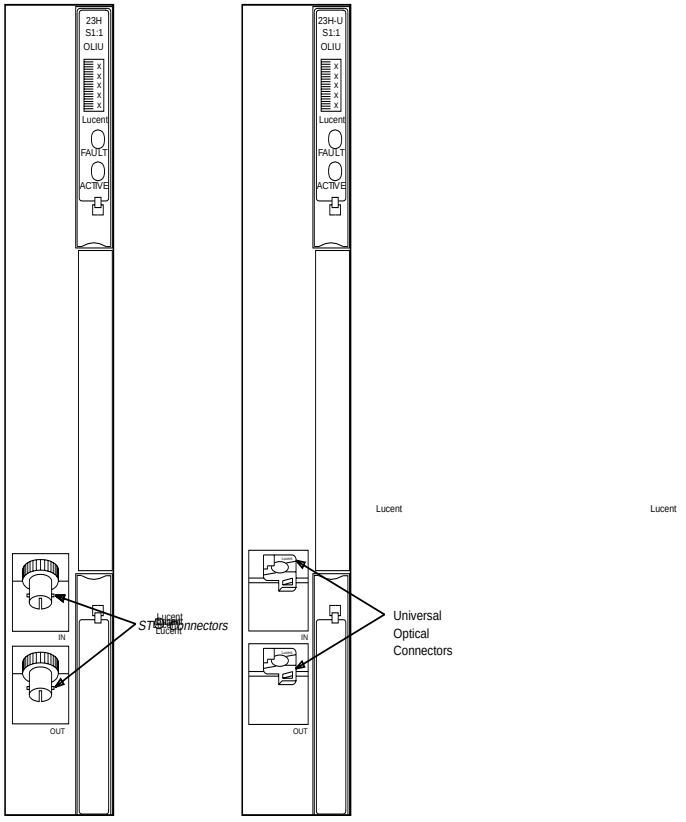


Figure 7-28. 23H and 23H-U OLIU Circuit Packs

General Description of Operation

The 23H/23H-U OLIU circuit pack provides an interface between an OC-12 optical line and 12 STS-1 signals and can be used in ring applications. The 23H/23H-U OLIU provides 24 STS-1 input ports, 12 from service and 12 from protection TSI circuit packs. It selects up to 12 STS-1 inputs, performs pointer processing and frame alignment on each STS-1, inserts transport overhead, and combines and scrambles the 12 STS-1 signals into an STS-12 (622.08 Mb/s) signal. The 23H/ 23H-U OLIU then performs an electrical-to-optical conversion and outputs an OC-12 optical signal for transmission on an optical fiber.

The 23H/23H-U OLIU receives an optical OC-12 signal and converts it to an electrical signal. It frames on and descrambles the signal, processes the transport overhead, and demultiplexes the STS-12 into 12 STS-1 signals. It performs pointer processing and frame alignment on each STS-1. The 23H/23H-U OLIU outputs 24 STS-1 signals, 12 to service and 12 to protection TSI circuit packs.

The 23H/23H-U OLIU performs maintenance and provisioning functions associated with the STS-1 and OC-12 inputs and outputs. It provides access to the line and section overhead in the STS-12 signal and interfaces to the TSI circuit pack at the STS-1 rate and to the optical line at the OC-12 rate. It interfaces to the SYSCTL and OHCTL and sends recovered timing signals to the TGS circuit packs. The 23H/23H-U OLIU receives its timing signals from the TSI circuit packs.

Fiber access is via a pair of *ST* (23H) or universal (23H-U) lightguide cable connectors from the 23H/23H-U OLIU faceplate. Single-mode fiber is suggested for optimum performance. The 23H/23H-U OLIU photonics meets SONET long reach specifications. The 23H/23H-U is not hardened for uncontrolled environments and is used in CO applications.

For 23H applications requiring external optical attenuators, the faceplate-mounted transmit (OUT) connector is designed to accept a lightguide buildout. Available buildouts are A3010B - 5 dB, A3010D - 10 dB, and A3010F - 15 dB. For loopback testing requiring 19 dB attenuation, use the 4C Test Cable. For 23H-U applications, see Section 10, "Technical Specifications," for a list of universal buildout attenuators.

Detailed Description of Operation

Transmission Circuitry

Transmit Direction. Figure 7-29 is a functional block diagram of the 23H/23H-U OLIU. The 23H/23H-U OLIU receives an STS-1 rate clock and an associated frame pulse from each of the working and standby TSI circuit packs. The 23H/23H-U OLIU, under control of the SYSCTL, normally selects signals from the working TSI. If a failure of the working clock is detected, the 23H/23H-U OLIU can be switched to the standby TSI under SYSCTL control. An STS-12 rate clock is generated from the STS-1 clock and used in creating the STS-12 signal. Under control of the SYSCTL circuit pack, the 23H/23H-U OLIU selects one group of 12 STS-1 signals from either of the 12 active or 12 standby STS-1 inputs. The 23H/23H-U OLIU performs pointer processing and frame alignment and adds transport overhead to the selected STS-1 signals. The 23H/23H-U OLIU provides access to the transport overhead which is sent to and received from the OHCTL.

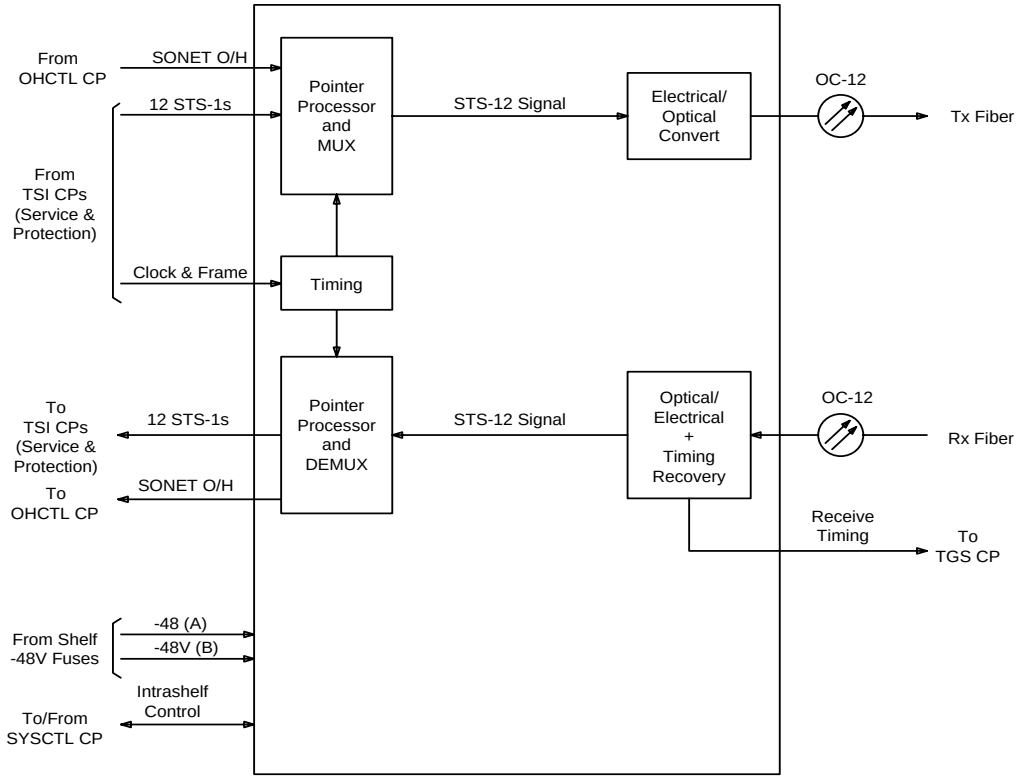


Figure 7-29. 23H/23H-U OLIU Circuit Pack Block Diagram

The STS-1 signals are byte-interleaved and scrambled in a frame synchronous scrambler to produce a SONET format compatible STS-12 signal. The STS-12 signal is used to amplitude modulate a laser transmitter to convert the electrical signal to an NRZ-encoded SONET compatible OC-12 optical signal.

Receive Direction. The 23H/23H-U OLIU circuit pack receives an OC-12 optical signal that is an NRZ-coded SONET compatible signal. An optical receiver converts the optical OC-12 signal to an electrical STS-12 signal. An STS-12 rate clock is recovered and used to retime the data.

The 23H/23H-U OLIU frames on the retimed STS-12 data, demultiplexes it into 12 STS-1 signals, and provides the transport overhead access.

The 23H/23H-U OLIU performs pointer interpretation, frequency justification, and pointer generation on each of the STS-1 signals, using the local clock and frame from the selected TSI circuit pack. The result is 12 STS-1 signals that are frame synchronous with each other and with the local clock and frame sync.

Each STS-1 signal is bridged to the service and protection TSI circuit packs.

The 23H/23H-U OLIU sends a clock derived from the recovered receive clock to the TGS circuit packs for loop timing. The 23H/23H-U OLIU provides transport overhead access in the receive direction.

Control Circuitry

The 23H/23H-U OLIU circuit pack interfaces with the SYSCTL and the OHCTL circuit packs.

Control and Maintenance Functions. The 23H/23H-U OLIU provides maintenance elements for reporting the status of the circuit pack and the incoming STS-1 and OC-12 signals to the SYSCTL. Conversely, the 23H/23H-U OLIU responds to control signals from the SYSCTL.

- SYSCTL: The 23H/23H-U OLIU communicates with the SYSCTL circuit pack via a control interface. The 23H/23H-U OLIU provides maintenance elements for reporting the status of the circuit pack and the incoming STS-1 and OC-12 signals. These maintenance elements are used by the SYSCTL for fault detection and isolation. Conversely, the 23H/23H-U OLIU responds to control signals from the SYSCTL, such as LED and protection switching controls.
- Transport Overhead Channel Interface: The 23H/23H-U OLIU accesses the SONET overhead and routes this data to the OHCTL.

Timing Circuitry

Each TGS circuit pack sends timing signals to the 23H/23H-U OLIU circuit pack via the TSI circuit packs.

The 23H/23H-U OLIU circuit pack sends a clock signal to both TGS circuit packs for loop timing.

Protection Circuitry

The 23H/23H-U OLIU provides STS-1 data path selectors for implementing a 1x1 protection switch between TSI circuit packs. The selectors are controlled by the SYSCTL.

The 23H/23H-U OLIU is protection switched by the SYSCTL in response to fault indications on the 23H/23H-U OLIU, or in response to fault indications on a transmission circuit pack with which it interfaces, or in response to external commands.

Fault Detection Circuitry

The 23H/23H-U OLIU circuit pack has in-service and out-of-service built-in test capability. In-service device testing is continuous, and errors are reported to the SYSCTL when they occur via the intra-shelf control bus. Incoming and outgoing optical power thresholds are also monitored.

There is no electrical loopback in the 23H/23H-U OLIU. All loopbacks are external optical loopbacks which require an attenuator.

Performance Monitoring

The 23H/23H-U OLIU provides PM circuitry for the following maintenance parameters:

- Parity error counts
- Incoming OC-12 OOF
- Outgoing OC-12 laser bias current threshold
- Line parameters based on B2 coding violations.

Power Circuitry

The 23H/23H-U OLIU circuit pack uses board-mounted DC-DC power converters that convert –48 V received from the backplane to +5 V, –5.2 V, +15 V, and –2.3 V for use on the circuit pack. The 23H/23H-U OLIU interfaces with both the A and B feeders and provides a "diode-ORed," so that loss of one feeder will not affect the 23H/23H-U OLIU. A fuse element is provided at the –48 V input to the DC-DC converter.

23H/23H-U OLIU Quick Reference Summary

Transmit Functions

The major transmit functions of the 23H/23H-U OLIU circuit pack are as follows:

- Selects 12 STS-1 signals from the TSI circuit packs
- Adds SONET transport overhead
- Byte-interleaves and scrambles the STS-1 signals to produce an STS-12 signal
- Modulates a laser transmitter to produce an OC-12 signal.

Receive Functions

The major receive functions of the 23H/23H-U OLIU circuit pack are as follows:

- Receives an OC-12 optical signal and converts an OC-12 signal to an electrical STS-12 signal
- Extracts STS-12 clock and retimes the received data
- Demultiplexes the STS-12 signal into 12 STS-1 signals
- Extracts and processes the STS-1 transport overhead
- Processes the STS-1 pointer and frame-synchronizes the STS-1 signals
- Processes the receive clock and provides a loop-timing clock to the TGS circuit packs.

Control Functions

Control functions are as follows:

- Protection switching for TSI circuit packs
- Inventory information (*CLEI* code, date of manufacture, etc.).

Maintenance Signal Functions

The 23H/23H-U OLIU major maintenance signal functions are as follows:

- Inserts and detects STS-1 path AIS
- Inserts STS-1 path unequipped signal
- Inserts and detects OC-12 line AIS
- Inserts and detects OC-12 line FERF
- Detects OC-12 line failures (LOS, LOF, AIS, and BER)
- Detects OC-12 line signal degrade BER.

177B Apparatus Blank Description

Purpose of Apparatus Blank

The 177B apparatus blank (Figure 7-30) must be installed in all unused function unit slots to ensure adequate cooling by controlling air flow through the shelf.

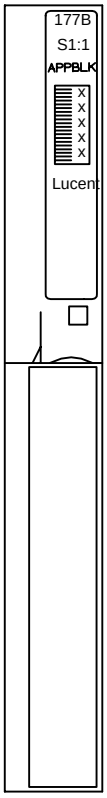


Figure 7-30. 177B Apparatus Blank

177C Apparatus Blank Description

Purpose of Apparatus Blank

The 177C (Figure 7-31) must be installed in the main-a-1 and main-a-2 slots to ensure adequate cooling by controlling air flow through the shelf.

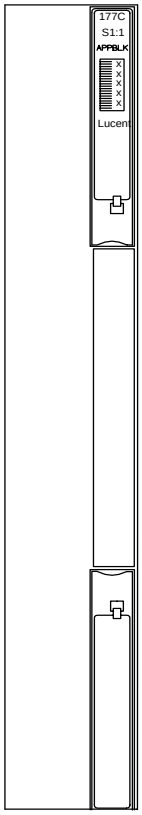


Figure 7-31. 177C Apparatus Blank

Administration and Provisioning

8

Table of Contents

Overview 8-1

Administration 8-1

- Version Recognition 8-1
- Security 8-2
- Software Upgrades 8-4
  - Remote Software Download and Copy 8-4
- Software Compatibility 8-4
  - Controller Maintenance 8-5
  - Memory Administration 8-5
- System Backup and Restoral 8-6
  - Service-Affecting Actions 8-6

Multiplexing and Mapping 8-7

- DS3 to OC-12 8-7
- OC-3 to OC-12 8-7
- OC-3c to OC-12 (Optional Feature) 8-8
- EC-1 to OC-12 8-8

Provisioning 8-9

- Default Provisioning 8-9
- Remote Provisioning 8-9
- Automatic Provisioning 8-9
  - Circuit Pack Replacement 8-9
- Feature Package Provisioning 8-10
- Data Communications Channel (DCC) Provisioning 8-10

Table of Contents

- Operations Interworking (OI) Provisioning 8-11
  - NSAP Provisioning 8-11
  - TARP Provisioning 8-12
  - Level 2 Provisioning 8-12
- Port State Provisioning 8-13
- Channel State Provisioning 8-13
- Line State Provisioning 8-14
  - Remote OS Access (TL1/X.25 GNE) 8-14
  - Remote CIT Login 8-14
  - Remote Software Download and Copy 8-14
  - Subnetwork Size 8-14

Cross-Connection Provisioning 8-15

- Cross-Connection Types 8-15
  - Ring (0x1) Cross-Connections 8-15
  - Video Cross-Connections 8-15
  - Drop and Continue Cross-Connections 8-15
  - Pass-Through Cross-Connections 8-16
- Manual OC-12 Ring Cross-Connections 8-16
  - Video/Broadband Applications 8-20
  - OC-12 Path Protected Ring Application 8-20
  - OC-12 Path Protected Ring Drop and Continue Application 8-20
- OC-12 Ring Network Cross-Connection Example 8-21
  - Ring Drop and Continue Cross-Connection Provisioning 8-25
  - OC-12 Ring Network Drop and Continue Cross-Connection Example 8-28
- Single Homed OC-3/OC-12 VT1.5 Path Switched Ring (0x1) 8-30
  - Example Cross-Connections 8-31
- Dual Homed OC-3/OC-12 VT1.5 Path Switched Ring (0x1) 8-34
  - Example Cross-Connections 8-34
  - Example Cross-Connections 8-36
- Switch Selectable Parameters 8-38
- Craft Interface Terminal (CIT) Selectable Parameters 8-39
  - Identifiers (IDs) 8-43
  - Performance Monitoring (PM) Parameters Provisionable via the CIT 8-43

Administration and Provisioning

8

Overview

This section describes the administration and provisioning features of the DDM-2000 OC-12 Multiplexer. The following topics are described in addition to the administration and provisioning features:

- Multiplexing and mapping
- Cross-connection provisioning for ring networks
- Listing of provisionable parameters with their ranges and default values.

Administration

Version Recognition

The DDM-2000 OC-12 Multiplexer provides automatic version recognition of all hardware, firmware, and software installed in the system. Each circuit pack *CLEI** code, equipment catalog item (ECI) code, apparatus code and series number, and serial number is stored on the circuit pack and is accessible by the system controller via the craft interface terminal (CIT). Circuit packs with socketed devices also report those devices and program identification (PID) codes. The system controller (SYSCTL) also reports the software version for the system. Refer to the **`rtrv-eqpt`** command in Section 11, "Commands and Reports."

* COMMON LANGUAGE is a registered trademark and CLEI, CLLI, CLCI, and CLFI are trademarks of Bell Communications Research, Inc.

Security

DDM-2000 OC-12 Multiplexers provide security capabilities to protect against unauthorized access to the system through the CIT, data communications channel (DCC), and TL1/X.25 interfaces. When security is enabled (default is disabled for the CIT and DCC and always enabled for TL1/X.25), four types of users are allowed access to the system with a valid login and password:

- Privileged users can execute all commands
- General users can execute any commands not restricted to privileged users
- Maintenance users can execute some of the general level and all “reports-only” commands that are not restricted to priviliged users
- Reports-only users can only execute commands that retrieve reports from the system.

When the system is first initialized, three default logins and passwords are provided which must be changed by a privileged user before security is enabled. At initialization, privileged users are those users who use the default logins and passwords. Replacement of the SYSCTL circuit pack causes the system to default back to the default logins and passwords. Up to 100 logins and passwords can be added, deleted, and changed by three authorized privileged users. Login and password security can be enabled or disabled. Timeouts can be provisioned independently for front and rear access CIT interfaces and the synchronous optical network (SONET) section DCC. Timeout is disabled on the TL1/X.25 interface. For more information on provisioning, see “System Turnup/Circuit Order,” in the TOP section of this manual (Volume II).

Authorized privileged users can establish general user and reports-only user logins using the **`set-lgn`** command. Authorized privileged users can also "lockout" access by general and reports-only users without deleting the login and password file.

The following commands are restricted to privileged users over the CIT and DCC interfaces. See 824-102-151, *DDM-2000 Multiplexers Operations Systems Engineering Guide* for TL1/X.25 command access privileges.

- **`init-sys`** — Initialize System
- **`rstr-passwd`** — Restore login and password file
- **`rtrv-lgn`** — Retrieve Login
- **`rtrv-passwd`** — Retrieve login and password file
- **`set-feat`** — Set Features
- **`set-fecom`** — Set Far-End Communications

- **set-lgn** — Set Login
- **set-secu** — Set Security
- **set-sync** — Set Synchronization characteristics.

When security is enabled (default is “disable”), the following additional commands become restricted to privileged users only:

- **apply** — Locally Overwrite Executing Software
- **cpy-prog** — Copy Program
- **dlt-osacmap** — Delete OS application context ID map
- **ent-osacmap** — Enter OS application context ID map
- **ent-tl1msgmap** — Enter TL1 message map for OS
- **ent-ulsdcc-l3** — Enter Upper Layer Section DCC - Layer 3
- **ent-ulsdcc-l4** — Enter Upper Layer Section DCC - Layer 4
- **dlt-ulsdcc-l4** — Delete Upper Layer Section DCC - Layer 4
- **init-pm** — Initialize Performance Monitoring
- **ins-prog** — Install Program
- **reset** — System Reset
- **set-date** — Set network element (NE) Date and time
- **set-ne** — Set NE name.
- **set-x25** — Set X.25 baud rate for OS.

Reports-only users can execute the following commands: **?** (help), **logout**, **rlgn**, **set-passwd** (their own), **toggle**, and all **rtrv** commands **except**, **rtrv-lgn**, and **rtrv-passwd**.

For details on these and other commands, see Section 11, "Commands and Reports."

Software Upgrades

The DDM-2000 OC-12 Multiplexer provides an in-service software installation capability to update the generic program in local and remote systems. Upgrades are distributed on *MS-DOS* * formatted diskettes containing the new software and an installation program. An enhanced software download feature allows the source NE to download compressed copies of the new generic to all the other nodes in the network. This downloaded software will remain inactive until the **apply** command is issued to overwrite the current software. This feature allows wide flexibility in scheduling upgrades throughout the network. These software upgrades are the primary mechanism to add new feature enhancements to the in-service DDM-2000 OC-12 network.

The **ins-prog** command supports software installation from a personal computer (PC) and the **cpy-prog** command supports software installation from one shelf to another shelf. For details on these and other commands, see Section 11, "Commands and Reports."

Remote Software Download and Copy

System software can be downloaded using a PC through the EIA-232-D interface on the user panel to another system connected to the local system via the SONET DCC. The DDM-2000 OC-3 and OC-12 Multiplexers can upgrade the system software while in-service. DDM-2000 OC-3 and OC-12 Multiplexers use flash erasable programmable read-only memory (flash EPROM) chips to provide this capability. Software can be downloaded from a PC to a remote NE even when the local shelf is a different member of the DDM-2000 product family or *SLC*-2000 from the remote shelf (for example, a DDM-2000 OC-12 at the CO and a DDM-2000 FiberReach at the RT site). Remote software download and copy is also supported in multi-vendor subnetworks, but only between DDM-2000 Multiplexers. The remote software download and copy capabilities enable the network service providers to avoid costly craft dispatches for software upgrade.

DDM-2000 can also accept software downloads from Lucent's ITM SNC R5.0 when upgrading from DDM-2000 OC-3 R13.0 and OC-12 R7.0 to subsequent releases.

Software Compatibility

DDM-2000 OC-12 Release 7.0 is NOT compatible with previous releases of DDM-2000 OC-12. Therefore, when upgrading a subnetwork, care should be taken to avoid isolating NEs that have not yet been upgraded to Release 7.0.Controller Maintenance and Memory Administration

* Registered trademark of Microsoft Corporation.

Controller Maintenance

The controller for the DDM-2000 OC-12 Multiplexer consists of the SYSCTL and OHCTL circuit packs. The SYSCTL circuit pack provides CIT interfaces and coordinates protection switching, as well as all shelf maintenance and provisioning activities. The OHCTL circuit pack provides an X.25 interface and a communications channel to remote shelves via the DCC bytes in the OC-N section overhead. Both circuit packs have a processor and both have volatile random access memory (RAM) and nonvolatile memory.

The DDM-2000 OC-12 Multiplexer is designed so that SYSCTL failures do not affect transmission. That is, no hits or errors will occur on any traffic as a result of a SYSCTL circuit pack failure. A SYSCTL failure does result in the loss of automatic protection switching. However, if a transmission circuit pack fails before a SYSCTL failure, the protection switch will remain effective during the SYSCTL failure and service is preserved. This means that if an active transmission circuit pack should fail while the SYSCTL is failed, a protection switch cannot be done and service carried by the failed circuit pack will be affected.

Memory Administration

All transmission affecting parameters that are set by software are stored in nonvolatile memory on the SYSCTL circuit pack and on the appropriate transmission circuit packs. When the shelf is powered up or the SYSCTL circuit pack is replaced, the shelf's transmission values are automatically uploaded to the SYSCTL. When a transmission circuit pack is replaced, provisioning data stored on the SYSCTL is automatically downloaded to the replacement circuit pack. Manual action is not required to maintain system provisioning after a circuit pack is replaced.

Certain non-service-affecting provisioned data, such as alarm delay are stored only on the SYSCTL circuit pack. This means that when a SYSCTL circuit pack is replaced, the new SYSTCL circuit pack should be initialized by pressing the INIT button during the 10-second interval while the CR alarm LED is flashing after the SYSCTL circuit pack is inserted. This action is the same as entering the **`init-sys:sysctl`** command which sets the SYSCTL circuit pack parameters to their default values. Refer to the **`init-sys`** command in Section 11, "Commands and Reports," and to "Install or Replace SYSCTL," in the TOP section of this manual (Volume II). If parameters other than the default values are needed, the values must be entered using the CIT. If the INIT function is not performed, whatever values that are stored in nonvolatile memory on the new SYSCTL circuit pack are used. Failure to follow the proper procedure may not cause transmission errors or loss of service but could affect maintenance. For example, an invalid TID could produce confusing TL1 reports to the OS.

System Backup and Restoral

The CPro-2000 Graphical User Interface (GUI) and Provisioning Tool includes a backup and restoral feature to protect provisioning information in ring networks. This feature saves a copy of a node's provisionable parameters so they can be restored at a later date, if necessary.

The feature provides backup and restoral for all provisionable parameters including:

- Network Element (NE) provisionable parameters
- Cross-connections
- Port and line provisionable parameters
- Performance Monitoring (PM) threshold parameters

Refer to Section 6, “Operations Interfaces,” of this manual for more information on CPro-2000. See also 365-576-130, *CPro-2000 User Manual,* Release 7.0, for more information on CPro-2000.

ITM SNC

All of the above backup and restore features are also available with the Integrated Transport Management SubNetwork Controller (ITM SNC), Release 5.0. Refer to 107-564-270, *Integrated Transport Management (ITM) SubNetwork Controller (SNC), User Guide,* for additional information.

Service-Affecting Actions

Although the DDM-2000 OC-12 Multiplexer is designed to minimize LOS due to equipment failure or human action, there are certain controller related actions that can cause a loss of provisioning data and possibly LOS. These actions include:

- Replacing a transmission circuit pack when the SYSCTL is failed or removed can result in a loss of provisioning data and LOS
- Replacing a transmission circuit pack in a shelf without power can result in a loss of provisioning data. LOS may continue on channels associated with the replaced circuit pack after the shelf is powered up.
- Executing the command **`init-sys:all`** sets all provisioning data, including cross-connect provisioning to default values. This causes LOS on any channel connected with nondefault cross-connections.
- Failing to disable the SYSCTL circuit pack before it is removed in accordance with TOP procedures. Failure to follow the procedure could result in unexpected events; however, no LOS occurs. Refer to the "Install or Replace SYSCTL" procedure in the TOP section of this manual (Volume II).
- Provisioning data is maintained through a software download to the SYSCTL. Replacing the SYSCTL circuit pack with incompatible software and intentionally overriding the software check could result in a loss of data.

Multiplexing and Mapping

The following paragraphs describe DS3 to OC-12, OC-3 to OC-12, EC-1 to OC-12, and OC-3c to OC-12 (feature package option) multiplexing and mapping.

DS3 to OC-12

Each DS3 signal received by a 3DS3 circuit pack is mapped to an STS-1 signal via the asynchronous mapping as specified in the SONET standard. The three STS-1 signals associated with a 3DS3 circuit pack are then multiplexed with the STS-1 signals from the other function units to form the STS-12 high-speed signal. The STS-12 signal is then converted to an OC-12 signal for transport on the high-speed optical line.

In the reverse direction, a received OC-12 signal is converted to an electrical STS-12 signal which is demultiplexed to 12 STS-1 signals. The STS-1 signals are routed to the function units where they are converted back into DS3 signals by the 3DS3 circuit packs.

OC-3 to OC-12

When a function unit is equipped with a 21-type OLIU circuit pack, the received optical signal is converted to an electrical STS-3 signal which is demultiplexed into three STS-1 signals. The three STS-1 signals are multiplexed with the STS-1 signals from the other function units to form an STS-12 signal, which is converted to an OC-12 signal for transport on the OC-12 line.

In the reverse direction, the received OC-12 signal is converted to an electrical STS-12 signal which is demultiplexed to 12 STS-1 signals. The STS-1 signals are routed to the function units where they are multiplexed to an STS-3 signal, which is converted to an OC-3 optical signal for transport on the optical line.

When the function unit service and protection slots are equipped with OLIUs, they can be provisioned as ring (0x1) low-speed interfaces or linear (1+1) optical extensions using the **`set-oc3`** command. The cross-connections can then be made using the **`ent-crs-sts1`** command. See Section 11, "Commands and Reports," for more information on this provisioning.

OC-3c to OC-12 (Optional Feature)

This application is a feature package option which must be enabled using the **set-feat** command.

A function unit can be optionally equipped with 21-type OLIUs for OC-3c transport. The incoming OC-3c signal is electrically converted into an STS-3c signal. Four STS-3c or a mix of STS-3c and STS-1 signals are multiplexed into an STS-12 signal and converted into an OC-12 signal for transport over the OC-12 line.

When the function unit service and protection slots are equipped with OLIUs, they can be provisioned as ring (0x1) low-speed interfaces or linear (1+1) optical extensions using the **set-oc3** command. The cross-connections can then be made using the **ent-crs-sts3c** command. See Section 11, "Commands and Reports," for more information on this provisioning.

EC-1 to OC-12

The 3STS1E low-speed interface receives an EC-1 signal from the backplane coaxial connector which is then routed as an internal STS-1. This signal is STS-1 cross-connected to the OC-12 interface. At the OC-12 interface, these internal STS-1 signals are multiplexed into an STS-12 and converted to an optical OC-12 signal.

Cross-connections are made using the **ent-crs-sts1** command. See Section 11, "Commands and Reports," for more information on this command.

In the opposite direction, a received OC-12 is converted into an electrical STS-12 and demultiplexed. After STS-1 cross-connections, the resulting STS-1 internal signal is converted to an EC-1 signal by the 3STS1E interface. The following are examples of STS-1 cross-connections in ring networks:

a-1 to mb-1
c-3 to mb-5
d-2 to mb-7

Provisioning

The DDM-2000 OC-12 Multiplexer allows the user to customize many system characteristics through its provisioning features. Provisioning parameters are set by a combination of on-board switches and software control.

Parameters likely to vary from installation to installation (for example, DS3 LBOs) and parameters that will not change in service (for example, OC-3 optical power) are set with on-board switches. This allows installations to be performed without a CIT using default provisioning values and switch settings. Other parameters that require a wide range of options or in-service changes are set under software control. For example, PM thresholds can be customized for each installation using the CIT.

Default Provisioning

Installation provisioning is minimized with default values set in the factory. Each parameter is given a default. The defaults for software parameters are maintained in the SYSCTL circuit pack. All provisioning data is stored in nonvolatile memory to prevent data loss during power failures.

Remote Provisioning

Software control of many provisioning parameters allows remote provisioning of the DDM-2000 OC-12 Multiplexer. This feature is provided especially for parameters likely to change in service, in support of centralized operations practices.

Automatic Provisioning

Circuit Pack Replacement

Replacement of a failed circuit pack is simplified by automatic provisioning of the current circuit pack values. The SYSCTL circuit pack maintains a provisioning map of the entire shelf, so when a transmission or synchronization circuit pack is replaced, the SYSCTL circuit pack automatically downloads values to the new circuit pack. If the SYSCTL circuit pack is ever replaced, provisioning, for example, transmission data, except for the LBO settings, from every other circuit pack in the shelf is automatically uploaded to the nonvolatile memory of the new SYSCTL circuit pack.

Feature Package Provisioning

Certain software features are available only through a special licensing agreement with Lucent Technologies. The OC-3c (STS-3c) feature is enabled by privileged-user logins according to the licensing agreement, using the **`set-feat`** command and can be reviewed using the **`rtrv-feat`** command. This feature is optional and may not be active on all systems. For details on these and other commands, refer to Section 11, "Commands and Reports."

Data Communications Channel (DCC) Provisioning

The DCC is automatically provisioned in the following manner and needs no provisioning by the user. The DCC uses the SONET overhead to communicate between NEs and follows the active SONET transmission line and/or IAO LAN.

In a given subnetwork, the NEs on each side of an optical span must have their "user-side/network-side" (OSI terminology) parameters provisioned to opposite values. Local procedures should determine the "user" and "network" side of a span. For example, the CO terminal can be designated the network side and the RT site the user side. It does not matter as long as the two sides are opposite values. See the TOP section of this manual (Volume II) for OI provisioning procedures.

- In rings, there is one DCC assigned for the "m1" ring and another DCC for the "m2" ring.
- When function unit slot pairs are provisioned for linear (1+1) applications (connected to OC-3 linear extensions), there is one DCC for each pair. When provisioned for ring (0x1) applications, there is one DCC for each slot.

Operations Interworking (OI) Provisioning

OI provides the capability to access, operate, administer, maintain, and provision remote Lucent NEs from other NEs in a subnetwork or from a centralized OS.

OI is supported among systems that are connected through the DCC. Table 8-1 lists the SONET software compatibility within a subnetwork for the Lucent 2000 Product Family systems. All configurations listed support OI. The table lists all possible software combinations. Combinations not listed are not supported.

Table 8-1. OI Software Compatibility

	OC-3	OC-12
Releases	13.0	7.0
OC-3, R13.0	X	X
OC-12, R7.0	X	X
FiberReach, R3.0	X	X
FT-2000, R8.0	X	X
SLC-2000, R3.3	X	X
SLC-2000, R4.4	X	X
TITAN 5500/S, R5.0	X	X
ITM SNC, R5.0	X	X
CPro-2000, R7.0	X	X

OI features include the following:

- Remote OS access (via TL1/X.25 GNE)
- Remote CIT login (remote technician access)
- Remote software download and copy

See also 824-102-144, *Lucent Technologies 2000 Product Family Multi-Vendor Operations Interworking Guide*.

NSAP Provisioning

The network services access point (NSAP) is a multiple part address that uniquely identifies each NE for OI purposes. The NSAP is used for subnetwork DCC communications using the OSI protocol. A unique NSAP is programmed into the SYSCTL circuit pack at the factory and does not have to be modified by the user unless subnetwork partitioning is necessary. This default NSAP value is adequate to operate typical subnetworks.

Subnetwork partitioning is accomplished by assigning NEs to different areas. An NE's area address is one of the subfields within its NSAP. The **`ent-ulsdcc-l3`** command is used to modify an NE's NSAP. See the **`ent-ulsdcc-l3`** command in Section 11, "Commands and Reports," for more information on NSAP provisioning.

TARP Provisioning

Although TARP functions automatically, using standard default values and without any user provisioning, DDM-2000 allows provisioning of the following TARP parameters. All TARP parameters are provisioned by the CIT and TL1 **ent-ulsdcc-l4**" command and include the following:

- Lifetime
- Manual Adjacency
- Timers
- Loop Detection Buffer (LDB) Flush Timer
- TDC Enable/Disable
- TDC TID-NSAP Entries

It is recommended that TARP default values always be used, with the possible exceptions of Manual Adjacency and the TDC parameters. TARP Manual Adjacency may be used to propagate TARP messages beyond any non-TARP nodes in a subnetwork, if necessary. In the unlikely event the TDC contains inaccurate information, the TDC parameters may be used to update the TDC.

Eliminated Provisioning: Because DDM-2000 OC-12 Release 7.0 does not support Lucent Directory Services (LDS) or Remote NE Status features, the following OI-related provisioning is no longer necessary:

- AGNE
- Alarm Group Number
- DSNE
- DSNE DLT-TADRMAP (CIT and TL1 command)
- NE Number
- Site Number
- TBOS Number

Level 2 Provisioning

Subnetwork partitioning also involves the assignment of level 2 Intermediate Systems (ISs). The **ent-ulsdcc-l3** command is used to assign DDM-2000 to serve as a level 2 IS. See the **ent-ulsdcc-l3** command in Section 11, "Commands and Reports," for more information on NSAP provisioning.

Port State Provisioning

Port state provisioning is a feature provided on DDM-2000 OC-12 Multiplexers that suppresses alarm reporting and PM by supporting multiple states (automatic [AUTO], in-service [IS], and not-monitored [NMON]) for DS3 and EC-1 ports.

Ports without signals (undriven) are in the AUTO state until changed to the IS state when a signal is present. The **set-state-t3** and **set-state-ec1** commands allow a user to change the state of a port to the NMON state or from the NMON state to the AUTO state. The **rtrv-state-eqpt**, **rtrv-t3**, and **rtrv-ec1** commands allow a user to retrieve current port states. The **upd** command allows a user to change the port state of all undriven ports from IS to AUTO.

Channel State Provisioning

Channel state provisioning is a feature provided on DDM-2000 OC-12 Multiplexers that suppresses reporting of alarms and events for STS-1 channels by supporting multiple states at the OC-12 ports (AUTO, IS, and NMON) for these channels. The **rtrv-state-sts1** command allows a user to retrieve current channel states.

While an end-to-end circuit is being set up, particularly during STS-1 cross-connection provisioning, transient maintenance signals may result. Without automatic channel state provisioning, these are reported as alarms or events. The technicians are expected to ignore these transient alarms and initiate corrective action only if the alarms persist after the provisioning is completed.

To avoid the confusion created by this, DDM-2000 OC-12 Multiplexers provide automatic channel state provisioning. An STS-1 channel stays in the default AUTO state until a valid signal, a framed signal that is not alarm indication signal (AIS) or unequipped is received on that channel. While in AUTO state, no alarms or events are reported on the channel by the DDM-2000 OC-12 Multiplexer. On receiving a valid signal, which occurs when the end-to-end circuit is completely provisioned, the channel automatically changes to the IS state, and normal alarm and event reporting starts. An additional state, NMON, is also supported in which alarm and event reporting is suppressed regardless of the validity of the signal being received on the channel. Like the port state provisioning capability provided for DS3 and EC-1 ports, the user can use CIT or TL1 commands to manually change a channel from IS or AUTO to NMON, and from NMON to AUTO. A direct change from NMON to IS is not allowed. See the **set-state-sts1**, **rtrv-state-sts1** and **upd** commands.

Line State Provisioning

Line state provisioning is a feature provided on DDM-2000 OC-12 Multiplexers that suppresses alarm reporting and PM by supporting multiple states (IS and NMON) for OC-3 lines. See the **`set-state-oc3`** and **`rtrv-state-oc3`** commands.

Remote OS Access (TL1/X.25 GNE)

A DDM-2000 subnetwork may have one or more NEs serving as TL1/X.25 GNEs. Without any user provisioning, a DDM-2000 is automatically a GNE upon connecting an X.25 link to its X.25 interface. Refer to the "TL1/X.25 Interfaces" paragraph in Section 6, "Operations Interfaces," for more information.

Remote CIT Login

Each DDM-2000 Multiplexer can remotely log into other DDM-2000 Multiplexers in the same subnetwork. OI also allows remote logins between DDM-2000 and the *SLC*-2000 Access System and from the FT-2000 OC-48 Lightwave System to other Lucent 2000 Product Family systems in the same subnetwork. Refer to Section 6, "Operations Interfaces," for more information.

Remote Software Download and Copy

The DDM-2000 OC-3 and OC-12 Multiplexers can upgrade the system software while in-service. Software can be downloaded locally using a PC through the EIA-232-D interface on the user panel or remotely over the SONET DCC. Refer to the "Software Upgrades" section at the beginning of this chapter for more information.

Subnetwork Size

There is no limitation on the size of the networks formed by splitting a large network into a number of smaller maintenance subnetworks by disabling the DCC between the subnetworks. Subnetwork partitioning can be done while in service without affecting traffic. Subnetwork sizes of up to 256 NEs are supported via subnetwork partitioning (50 per level 1 area, 256 per subnetwork) with multiple areas connected via level 2 Intermediate Systems (IS). Refer to 824-102-144, *Lucent Technologies 2000 Product Family Multi-Vendor Operations Interworking Guide,* for additional information.

Cross-Connection Provisioning

Cross-Connection Types

DDM-2000 OC-12 Multiplexers have time slot interchange (TSI) features. This offers users flexibility in directing traffic in and out of these systems to support a wide variety and range of customer applications.

The DDM-2000 OC-12 Multiplexer can be provisioned for cross-connect routing of signals. For rings, STS-1 signals may be manually cross-connected in several ways. For bidirectional drop services, the normal "twoway" cross-connection is used to connect a signal in the high-speed slot to any available time slot in any function unit equipped with low-speed 3STS1E or 3DS3 circuit packs.

Ring (0x1) Cross-Connections

For ring (0x1) interfaces, a manual "twoway" cross-connection command (**`ent-crs-sts1`**) is used to connect a signal in the high-speed slot to one or both function unit slots equipped with 21-type OLIU circuit packs.

Video Cross-Connections

For video cross-connections at central office video (COV) and remote terminal video (RTV) sites, an incoming STS-3c signal from each function unit slot equipped with 21-type OLIUs are connected to ring 1 and ring 2 respectively in a one-way unprotected mode. This provides up to eight different STS-3c signals on the ring.

For video cross-connections at RT site applications, up to four incoming STS-3c signals from ring 1 and four from ring 2 are dropped to FN ()-1 and FN ()-2 slots respectively and continued on both rings to the next node.

The primary commands associated with these cross-connections are:

- The **`set-oc3`** command has a parameter for identifying this application
- The **`ent-crs-sts3c`** command has parameters for identifying either COV or RTV nodes
- The **`set-state-oc3`** command is used to set unused input ports of the function unit OLIUs at RTV sites to the NMON state to prevent optical alarms.

Drop and Continue Cross-Connections

End-to-end survivable service facilities need to cross multiple rings interconnected at multiple (dual) wire centers. To support these applications, a drop-and-continue cross-connection is provided for a signal from a high-speed channel to be dropped to a specified low-speed port or channel and continued on to the next node in the same

direction while also adding a corresponding signal from the low-speed port or channel to the high-speed channel in the other rotation of the ring.

Drop and continue cross-connections are used in DRI applications. Drop and continue cross-connections are only allowed if the function units are equipped with 3STS1E, 3DS3, or 21-type OLIUs. If OLIUs are used, the function unit slots must be provisioned as linear (1+1).

The "drop and continue" cross-connection provides, in a single command (**ent-crs**), the proper bidirectional cross-connection to "drop" a copy of the high-speed signal in the main-B slot to any available time slot in any function unit and to "continue" the signal on the high-speed channel to the next node. The same command also properly drops the signal from the opposite ring direction.

Pass-Through Cross-Connections

Pass-through cross-connections allow a high-speed STS-1 or STS-3 channel to be "passed-through" between two high-speed ring interfaces. This is used in all path switched ring applications at nodes where traffic is not dropped.

In path switched rings, pass-through grooming (passing a signal on a ring time slot that is different from the ring time slot on which it was received) is not supported. The bidirectional pass-through cross-connection is used to connect the high-speed signal from one side of the ring to the other side. Both rings are properly connected, using a single "twoway" (**ent-crs**) command. The high-speed time slot address entering must be the same time slot address leaving in pass-through connections.

Manual OC-12 Ring Cross-Connections

Cross-connections in DDM-2000 OC-12 Multiplexers are made by specifying the SONET rate (STS-1 or STS-3c), the end point addresses (access identifiers), the cross-connection type (twoway, drop and continue, etc.) and, in some cases, the ring direction (ring=mb1, ring=mb2, etc.). In DDM-2000 OC-12 Multiplexers, each single cross-connection command establishes a two-way cross-connection.

All nodes in the ring must be provisioned for STS-1 or STS-3c cross-connections. Refer to Section 11, "Commands and Reports," for more information on these commands.

DDM-2000 OC-12 rings provide flexible routing of STS-1 or STS-3c signals between high-speed and function unit interfaces. These "manual" cross-connections are entered using the CIT and are shown in Table 8-2 through Table 8-9. These cross-connection types can be "mixed and matched" in a single system (for example, STS-1s, STS-3cs, pass-through and drop and continue).

Table 8-2 throughTable 8-9 list the various types of supported cross-connections. Following the tables are descriptions of applications and the cross-connections each application requires.

Table 8-2. DDM-2000 OC-12 Manual STS-1 Cross-Connections (Termination).

From		To	"To" CP Type	Example Command *
mb-{1-12}	<-->	a-{1-3}	3STS1E, 3DS3, OLIU	ent-crs-sts1:mb-1,a-1
mb-{1-12}	<-->	b-{1-3}	3STS1E, 3DS3, OLIU	ent-crs-sts1:mb-2,b-3
mb-{1-12}	<-->	c-{1-3}	3STS1E, 3DS3, OLIU	ent-crs-sts1:mb-3,c-2
mb-{1-12}	<-->	d-{1-3}	3STS1E, 3DS3, OLIU	ent-crs-sts1:mb-4,d-2

* Cross-connection type is not entered because default is twoway.

Table 8-3. DDM-2000 OC-12 Manual STS-3c Cross-Connections (Termination).

From		To	"To" CP Type	Example Command *
mb-{1,4,7,10}	<-->	a-1	21-type OLIU	ent-crs-sts3c:mb-1,a-1
mb-{1,4,7,10}	<-->	b-1	21-type OLIU	ent-crs-sts3c:mb-4,b-1
mb-{1,4,7,10}	<-->	c-1	21-type OLIU	ent-crs-sts3c:mb-7,c-1
mb-{1,4,7,10}	<-->	d-1	21-type OLIU	ent-crs-sts3c:mb-10,d-1

* Cross-connection type is not entered because default is twoway.

Table 8-4. DDM-2000 OC-12 Manual STS-1 Cross-Connections (Rings Pass-Through)

From		To	"To" CP Type	Example Command *
mb-1	<-->	mb-1	23-type OLIU	ent-crs-sts1:mb-1,mb-1
mb-2	<-->	mb-2	23-type OLIU	ent-crs-sts1:mb-1,mb-2
mb-3	<-->	mb-3	23-type OLIU	ent-crs-sts1:mb-1,mb-3
mb-4	<-->	mb-4	23-type OLIU	ent-crs-sts1:mb-1,mb-4
mb-5	<-->	mb-5	23-type OLIU	ent-crs-sts1:mb-1,mb-5
mb-6	<-->	mb-6	23-type OLIU	ent-crs-sts1:mb-1,mb-6
mb-7	<-->	mb-7	23-type OLIU	ent-crs-sts1:mb-1,mb-7
mb-8	<-->	mb-8	23-type OLIU	ent-crs-sts1:mb-1,mb-8
mb-9	<-->	mb-9	23-type OLIU	ent-crs-sts1:mb-1,mb-9
mb-10	<-->	mb-10	23-type OLIU	ent-crs-sts1:mb-1,mb-10
mb-11	<-->	mb-11	23-type OLIU	ent-crs-sts1:mb-1,mb-11
mb-12	<-->	mb-12	23-type OLIU	ent-crs-sts1:mb-1,mb-12

* Cross-connection type is not entered because default is twoway. Address on the left side MUST BE identical to the address on the right side. There is no interchange function for "pass-through" signals.

Table 8-5. DDM-2000 OC-12 Manual STS-3c Cross-Connections (Rings Pass-Through)

From		To	"To" CP Type	Example Command *
mb-{1,4,7,10}	<-->	mb-{1,4,7,10}	23-type OLIU	ent-crs-sts3c:mb-7,mb-7

* Cross-connection type is not entered because default is twoway. Address on the left side MUST BE identical to the address on the right side. There is no interchange function for "pass-through" signals.

Table 8-6. DDM-2000 OC-12 Manual STS-1 Cross-Connections (Rings Drop and Continue)

From		To	"To" CP Type	Example Command *
mb-{1-12}	<-->	a-{1-3}	3STS1E, 3DS3, OLIU	ent-crs-sts1:mb-1,a-1:cct=dc,ring=mb1
mb-{1-12}	<-->	b-{1-3}	3STS1E, 3DS3, OLIU	ent-crs-sts1:mb-2,b-3:cct=dc,ring=mb1
mb-{1-12}	<-->	c-{1-3}	3STS1E, 3DS3, OLIU	ent-crs-sts1:mb-3,c-2:cct=dc,ring=mb2
mb-{1-12}	<-->	d-{1-3}	3STS1E, 3DS3, OLIU	ent-crs-sts1:mb-4,d-2:cct=dc,ring=mb2

* The "ring" parameter defines the ring carrying the continue signal. This ring connects to the other drop and continue shelf.

Table 8-7. DDM-2000 OC-12 Manual STS-3c Cross-Connections (Rings Drop and Continue)

From		To	"To" CP Type	Example Command *
mb-{1,4,7,10}	<-->	a-1	21-type OLIU	ent-crs-sts3c:mb-1,a-1:cct=dc,ring=mb1
mb-{1,4,7,10}	<-->	b-1	21-type OLIU	ent-crs-sts3c:mb-4,b-1:cct=dc,ring=mb1
mb-{1,4,7,10}	<-->	c-1	21-type OLIU	ent-crs-sts3c:mb-7,c-1:cct=dc,ring=mb2
mb-{1,4,7,10}	<-->	d-1	21-type OLIU	ent-crs-sts3c:mb-10,d-1:cct=dc,ring=mb2

* The "ring" parameter defines the ring carrying the continue signal. This ring connects to the other drop and continue shelf.

Table 8-8. DDM-2000 OC-12 Manual STS-3c Cross-Connections (RTV)

From		To	"To" CP Type	Example Command
mb-{1,4,7,10}	<-->	a-1	21-type OLIU	ent-crs-sts3c;mb-1,a-1:cct=rtv
mb-{1,4,7,10}	<-->	b-1	21-type OLIU	ent-crs-sts3c;mb-4,b-1:cct=rtv
mb-{1,4,7,10}	<-->	c-1	21-type OLIU	ent-crs-sts3c;mb-7,c-1:cct=rtv
mb-{1,4,7,10}	<-->	d-1	21-type OLIU	ent-crs-sts3c;mb-10,d-1:cct=rtv

Table 8-9. DDM-2000 OC-12 Manual STS-3c Cross-Connections (COV)

From		To	"To" CP Type	Example Command
mb-{1,4,7,10}	<-->	{a,b,c,d}-1	23-type OLIU	ent-crs-sts3c:a-1,mb-4:cct=cov

Video/Broadband Applications

For video cross-connections at COV and RTV sites, up to four incoming STS-3c signals from each 21-type OLIU in FN ()-1 and FN ()-2 slots are connected to ring 1 and ring 2 respectively in a one-way unprotected mode.

OC-12 Path Protected Ring Application

This is a path protected ring application with multiple NEs in a two-fiber ring. The main optical units of each node in the ring are equipped with ring OLIU circuit packs, the 23G/23G-U or 23H/23H-U, to transport signals to the next NE as well as drop signals at the NE. Valid mapping is provided by termination and pass-through cross-connections.

OC-12 Path Protected Ring Drop and Continue Application

This is a path protected ring application with multiple NEs in a two-fiber ring. All but two nodes are normal ring application nodes (see previous application). Two nodes are defined to be the drop and continue nodes and may or may not be neighbors (no intermediate nodes). They function to provide two copies of each service on the ring to another ring (DRI) or to wire centers (dual wire center service). Special drop and continue cross-connections are used to support this feature. The 3STS1E, 3DS3, and 21-type OLIU circuit packs are used to transport traffic between rings or to the wire centers. This feature provides node failure survival functionality. These two special nodes can also provide normal ring functionality at the same time.

OC-12 Ring Network Cross-Connection Example

The following paragraphs describe a ring network example configuration and describe how to create manual cross-connections to establish the ring network. The example configuration is a ring network with two ring fibers and six nodes. Ring 1 carries ring traffic in the clockwise direction while Ring 2 carries ring traffic in the counterclockwise direction. For the purposes of this example, it is assumed that each shelf has recently been installed, equipped with 23G/23G-U or 23H/23H-U OLIUs in the main-B1 and main-B2 slots and 3DS3s in the function unit slots, and all shelves are properly installed and provisioned. This example is for DS3 services. See "System Turnup/Circuit Order" in the TOP section of this manual (Volume II). Figure 8-1 shows the six nodes with dashed lines, indicating the cross-connections.

Ring configurations support manual STS-1 cross-connections. Manual cross-connections must be made at **each** node in the network for each circuit being established. Drop cross-connections are made at the drop nodes where service enters or exits the node (Nodes 1 and 5), and pass-through cross-connections are made at **each** intermediate node (Nodes 2, 3, 4, and 6).

The example is for DS3 services but can be used for STS-1 services if the function units are properly equipped with 3STS1E circuit packs. The 3STS1E circuit pack can support three STS-1 cross-connections.

Pass-through cross-connections may be established first to minimize alarms. The example assumes that the drop cross-connections are made shortly after the pass-through cross-connections are made. This is the preferred method, since it assures that all cross-connections are associated with services.

An alternate method is also possible. Before service is established, all shelves can be defaulted to set up all pass-through cross-connections in the ring. This method has the advantage of only having to delete pass-through and establish drop cross-connections at the add/drop nodes. However, this method may introduce the possibility of affecting service when cross-connections are deleted. This is because it will not be possible to distinguish between pass-through cross-connections that are in use carrying service from those that are available. Use of this default pass-through provisioning method is only recommended if the accuracy of the cross-connection information on the work order is assured.

The following commands may be used to delete, enter, and retrieve cross-connections: **`dlt-crs-sts3c`**, **`ent-crs-sts3c`**, **`rtrv-crs-sts3c`**, **`dlt-crs-sts1`**, **`ent-crs-sts1`**, and **`rtrv-crs-sts1`**. See Section 11, "Commands and Reports," for a description of these commands.

It is important that the pass-through signal is assigned the same channel address for all nodes in the ring, including the add/drop nodes **mb-1** in the example.

Do the following procedure:

1. Using the work order, identify the TIDs of the entry and exit points on the ring (Nodes 1 and 5 in the example).
2. Determine if the work order is specifying use of a particular ring channel (some work orders may abbreviate the **mb** designation as **m1)**. If the work order does not designate an STS-1 ring channel to use, use the **rtrv-crs-sts1:all;** to identify all unused ring channels. The output report will show only active cross-connections. In the example, we will cross-connect a DS3 from Node 1 through the ring and drop the DS3 at Node 5 using **mb-1**.
3. Log in or remote log in to all the TIDs that are not entry and exit points (intermediate nodes) and enter ring "pass-through" cross-connections. At each intermediate node of the network, use the **ent-crs-sts1:** command to cross-connect the DS3 channel time slots between main B-1 and main B-2. For example, to cross-connect the channel time slots associated with STS-1 #1, use the **ent-crs-sts1:mb-1,mb-1** command.

   NOTE:
   Address 1 and address 2 must be the same.

4. Log in or remote log in to each drop node and enter the "drop" cross-connection. At both drop nodes of the DS3 circuit being established, use the **ent-crs-sts1:** command to cross-connect the DS3 channel time slot to the proper group, slot, and port; for example, **ent-crs-sts1:mb-1,a-1.**

   NOTE:
   Only one command is required to establish the drop cross-connections on **both** rings between main B and Fn-A. At exit nodes, assuming normal operation, the same signal is present on both rings. The system monitors the input from each ring and selects one to drop to Fn-A.

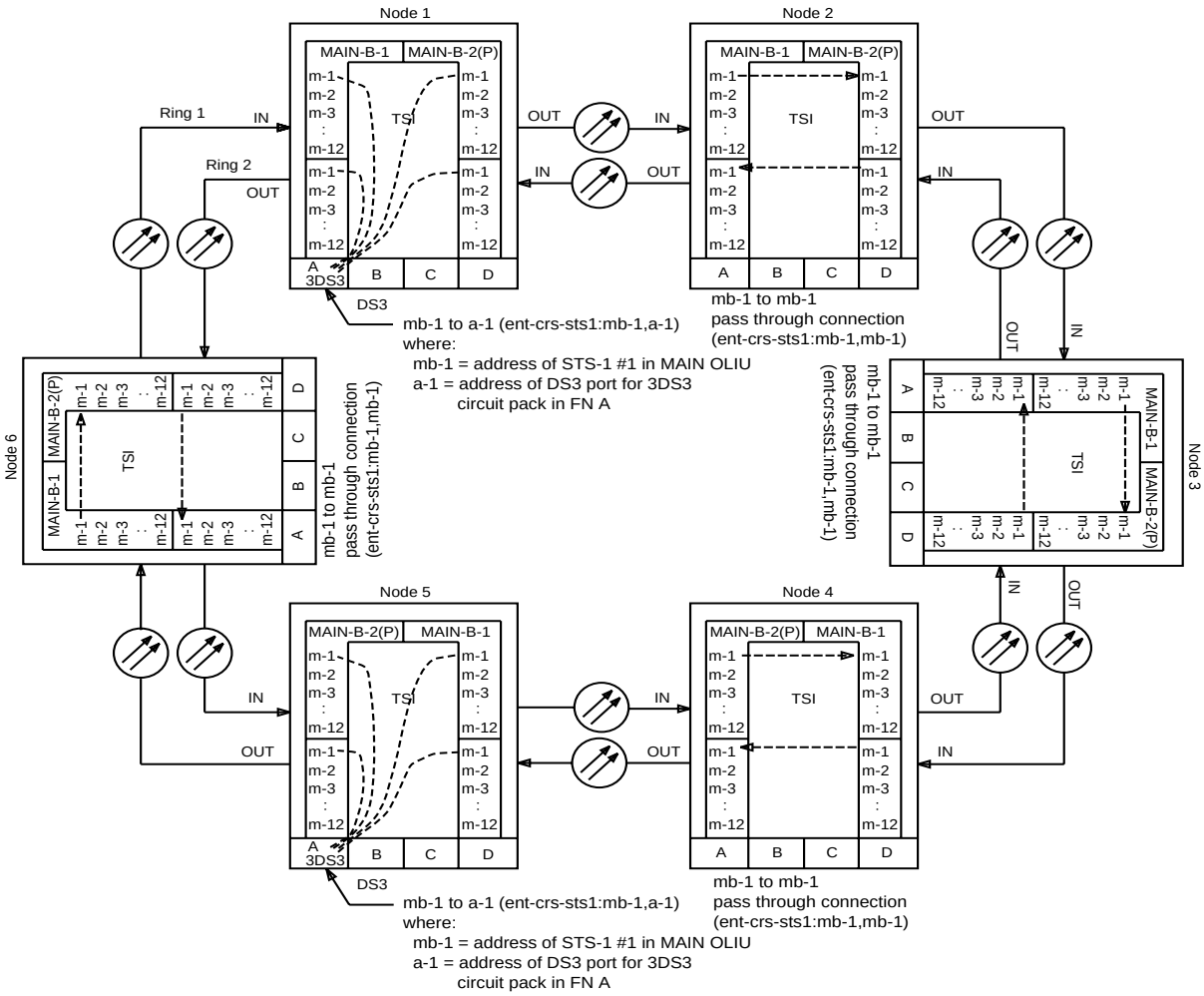


Figure 8-1. OC-12 Ring Configuration Cross-Connections — DS3 to DS3 With STS-1 Cross-Connections

5. Status and alarm conditions can be present during the provisioning operation but will clear once the last ring cross-connection for this DS3 service is completed. If they do not, the **rtrv-alm;** and **rtrv-crs-sts1;** commands can be used to isolate the problem (see the TOP section of this manual [Volume II]).

6. Log in or remote log in to all the nodes and verify appropriate drop or pass-through ring cross-connections.

7. Test both paths around the ring. Since DDM-2000 OC-12 uses non-revertive path switching to minimize the number of hits on services, the initial path selection is arbitrary. Use **rtrv-state-path** and **sw-path-sts1** commands to test both ring paths around the ring network at the drop nodes of the new service. The **sw-path-sts1** command should be limited to the addresses that are being tested. For the example, the commands are **sw-path-sts1:mb1-1** and **sw-path-sts1:mb2-1**.

   The **rtrv-state-path** and **sw-path-sts1** commands use slightly different STS-1 ring channel designations from the cross-connect designations because these commands need to identify which of the two paths around the ring is currently active. If the ring path and selected STS-1 channel are being received on main B-1, the active ring channel designation for the **rtrv-state-path** and **sw-path-sts1** commands will be **mb1-1**, where the **mb1** is the path received on main B-1. If the ring path and selected STS-1 channel are being received on main B-2, the ring channel designation for the **rtrv-state-path** and the **sw-path-sts1** commands will be **mb2-1**, where the **mb2** is the path received on main B-2. The DDM-2000 OC-12 allows a per path designation on the **sw-path-sts1** command. This assures that only the new DS3 service being provisioned will be subject to protection switch hits. If this is not the first DS3 service being added to the ring, it is strongly recommended that the pulling of circuit packs or fibers to test the protection path not be done since it would subject existing DS3 services to protection switch hits.

Ring Drop and Continue Cross-Connection Provisioning

All the information on "Ring Cross-Connection Provisioning" applies to "Ring Drop and Continue Cross-Connection Provisioning." Please review "Ring Cross-Connection Provisioning" as that information is not repeated here. Only the new provisioning information is presented here. This information applies to STS-1 traffic. Only the cross-connection addresses are different.

Two nodes are defined to be drop and continue nodes in a ring subnetwork and are the exit points where "two" copies of the same service are available. By making two copies of the same service available at two nodes, the network is protected from failure of a node (for example, a CO) that affects all traffic on the ring. For rings that carry drop and continue services, the drop and continue nodes should be neighbors (no intermediate nodes), and all "drop and continue" traffic must be continued on the ring connecting the two nodes. If the two nodes are not "neighbors," special procedures are required at the intermediate node. See the TOP section of this manual (Volume II).

In Figure 8-2 (one half of a drop and continue DRI application), CO 1 and CO 2 are drop and continue nodes. Traffic continued at CO 1 used Ring 2, which is the fiber connecting CO 1 to CO 2. Likewise, continued traffic at CO 2 used Ring 1, which is the fiber connecting CO 2 to CO 1.

When a new service is added to the ring, use the normal procedures to add service to all nodes of a ring except to the drop and continue nodes. Before a drop and continue cross-connection can be made to a low-speed function unit, the slots must be equipped with 3STS1E, 3DS3, or 21-type OLIU circuit packs. These circuit pack types are the interface for drop and continue applications. If OLIUs are used, the function unit slots must be provisioned for linear (1+1) applications.

NOTE:
Unless you have a specific application requiring DS3 interfaces, such as video or DS3 clear channel, it is recommended that DRI be done with SONET interfaces. This is because incoming asynchronous DS3 failures, such as loss of signal (LOS) or alarm indication signals (AIS), at drop and continue nodes will not generate SONET STS AIS if drop and continue cross-connections are made on a 3DS3 circuit pack. As a result, path protection switching will not occur on the OC-12 ring resulting in unusable signals at the terminating end. See "Gateway Between SONET and Asynchronous Interfaces" in Section 2, "Applications," for an example of this application.

The cross-connection command for drop and continue at CO 1 has two parameters. They are cross-connection type (cct) and ring identification (ring). The cct is "dc" for drop and continue. The parameter ring defines the direction of the continued signal. At CO 1 the ring is "mb2," which means to continue the signal on Ring 2 toward CO 2.

Similarly at CO 2, the other drop and continue node, the cross-connection command requires the same two parameters. The cct is "dc" and the parameter ring is "mb1," which means to continue the signal on Ring 1 toward CO 1.

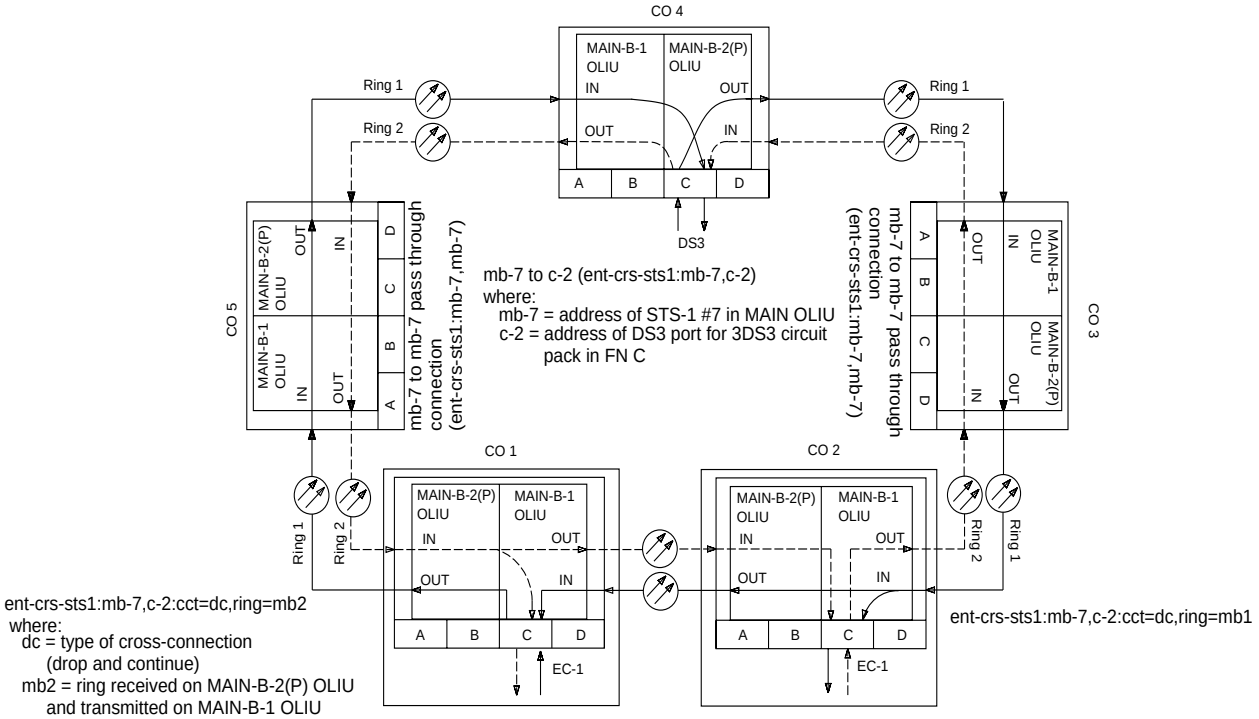


Figure 8-2. Drop and Continue Nodes

OC-12 Ring Network Drop and Continue Cross-Connection Example

Figure 8-3 shows a DRI network.

1. The user wants to provision a fully protected service using drop and continue cross-connections in this dual ring topology. The service is a DS3 at RT2 (bottom node in figure) to CO 4 (top node in figure).
2. All nodes require the same release of drop and continue ring software. The two terminating nodes (CO 4 and RT2) require low-speed 3DS3 circuit packs in a function unit as defined by the work order.
3. The site CO 1 has two NEs: one is part of the upper ring subnetwork and the other is a part of the lower subnetwork. They are connected by EC-1 signals provided by 3STS1E low-speed circuit packs. The figure shows these connections in function unit C of both NEs, but any available function unit can be used.
4. Note in the figure the identification of Ring 1 (clockwise) and Ring 2 (counterclockwise). This identification is a key to correct provisioning and needs to be checked before cross-connections are made.
5. The work order will specify the low-speed channel of the DS3 service, the available high-speed channel on the lower ring, and the low-speed channel assigned at the drop and continue nodes. While it is not required by DDM-2000 that the low-speed channel of the drop and continue nodes be the same, it is recommended to simplify record keeping.
6. For this example, the cross-connections are:

   ent-crs-sts1:c-2,mb-7 at RT2 (twoway drop)
   ent-crs-sts1:mb-7,mb-7 at RT3 and RT1 (pass-through)
   ent-crs-sts1:mb-7,c-2:cct=dc,ring=mb1 at CO 1 (lower NE)
   ent-crs-sts1:mb-7,c-2:cct=dc,ring=mb2 at CO 2 (lower NE).

   The continued signal at CO 1 must be assigned to Ring 1 ("mb1") and the continued signal at CO 2 must be assigned to Ring 2 ("mb2").
7. In a similar manner, the upper ring is provisioned according to the work order. The high-speed and low-speed addresses do not have to be the same as the ones used in the lower ring, but they must follow the rules for rings, which is to assign a single high-speed channel to all nodes for this DS3 service. For this example, the cross-connections are:

   ent-crs-sts1:mb-7,c-2:cct=dc,ring=mb2 at CO 1 (upper NE)
   ent-crs-sts1:mb-7,c-2:cct=dc,ring=mb1 at CO 2 (upper NE)
   ent-crs-sts1:mb-7,mb-7 at CO 3 and CO 5 (pass-through)
   ent-crs-sts1:c-2,mb-7 at CO 4 (two-way drop).

   The continued signal at CO 1 must be assigned to Ring 2 ("mb2"), and the continued signal at CO 2 must be assigned to Ring 1 ("mb1").

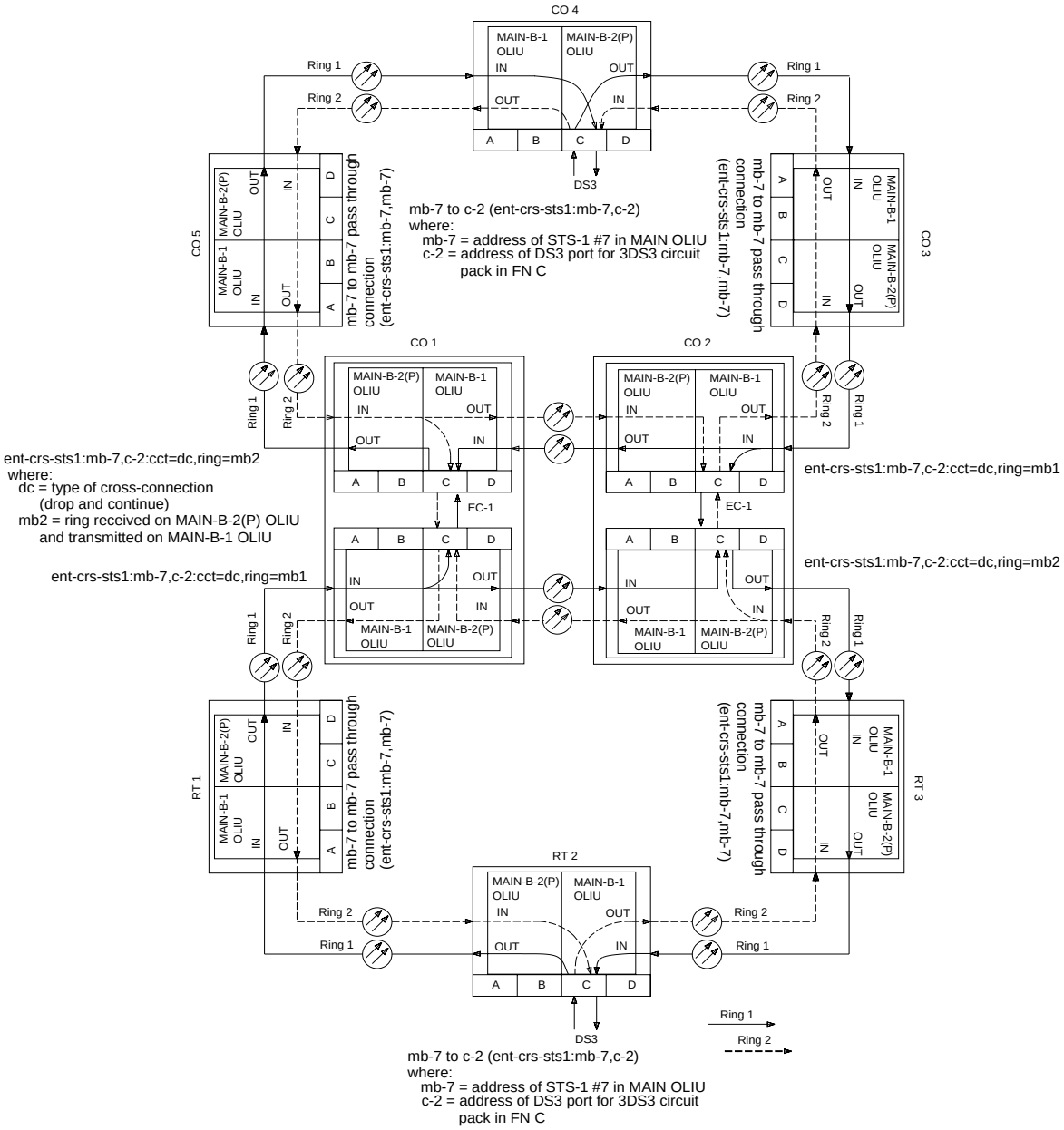


Figure 8-3. Example Dual Ring Configuration Cross-Connections

Single Homed OC-3/OC-12 VT1.5 Path Switched Ring (0x1)

Figure 8-4 shows an example of an OC-3/OC-12 VT1.5 path switched ring (0x1) single homing application. The figure is placed after the example explanation and can be removed for reference.

The DDM-2000 OC-12 ring supports ring (0x1) OC-3/IS-3 interfaces in its function unit slots. These interfaces must be provisioned as ring (0x1). Signals pass through the DDM-2000 OC-12 transport ring and exit to the DDM-2000 OC-3 ring. OC-12 function unit slot fn(x)-1 is connected to OC-3 main-1 and OC-12 function unit slot fn(x)-2 is connected to OC-3 main-2. Switching is not done on the DDM-2000 OC-12 Multiplexer on these lines, or paths on these lines; rather VT1.5 or STS-1 level path switching is done on the DDM-2000 OC-3 Multiplexer. This allows DDM-2000 OC-3 nodes running ring software to interface with DDM-2000 nodes of an OC-12 ring in such a way as to provide ring-on-ring architecture. Each OC-3 ring so supported occupies up to three STS-1 time slots on the OC-12 ring. Each OC-12 node can provision the same STS-1 time slots as other OC-12 nodes to drop to the OC-3 shelf (to share STS-1s among several OC-3 shelves) or the OC-12 node can provision different STS-1s at different sites. When ring (0x1) is used, the OC-12 ring passes the contents of these STS-1 time slots between the low-speed OC-3/IS-3 lines and OC-12 high-speed lines without terminating them or performing any path protection switching on them. Up to four OC-3 rings can be supported in this fashion by an OC-12 ring to maximize the OC-12 bandwidth utilization. This allows access to any and all VT1.5 signals at an OC-12 site. Since the high-speed signals from the OC-3 ring(s) are sent as two copies (one clockwise, the other counterclockwise) on the OC-12 ring, the OC-12 ring capacity is limited to the OC-12 line rate.

The OC-3/IS-3 lines between an OC-12 node and an OC-3 node connected in a ring 0x1 fashion behave like the OC-3 lines between the nodes on an OC-3 ring and do not perform line level protection switching. Instead, the OC-3 shelves perform the normal path protection switching functions.

Some points to note for this application are:

- Ring (0x1) can be thought of as a "ring on ring" with many of the characteristics of a single ring.
- Pass-through cross-connections may be required at the VT and STS level.
- The OC-3 ring can be composed of any three STSs in the OC-12.
- An OC-12 STS may be the first STS in one extension, the second STS in another, and the third STS in another.

Example Cross-Connections

The OC-12 (STS level) cross-connections are:

- At CO: mb-1:a-3

  mb-1 is dropped to the third STS in the OC-3 between CO and CO-1.

- At RT1: mb-1:a-1

  mb-1 is dropped to the first STS in the OC-3 between RT1 and RT1-1.

- At RT2: mb-1:c-2

  mb-1 is dropped to the second STS in the OC-3 between RT2 and RT2-2.

- At RT3: mb-1:b-3

  mb-1 is dropped to the third STS in the OC-3 between RT3 and RT3-3.

- At RT4: mb-1:mb-1

  mb-1 is passed through RT4 at the STS level.

These cross-connections can be thought of as establishing one STS of an OC-3 ring embedded in the OC-12 system. This is sometimes referred to as a "ring on ring." In the example, the OC-3 nodes are CO-1, RT1-1, RT2-2, and RT3-3. The STS itself traverses all nine nodes. An "ordinary" STS (for example, one that carries a DS3 from an originating node to a terminating node) can drop at only two locations (terminate in two-way at the source and destination), and pass-through cross-connections are needed at the intermediate nodes. There can be multiple drop (ring 0x1) type cross-connections to optical extensions.

The VT cross-connections that follow drop or pass through individual VTs in the STSs. This is like an ordinary OC-3 ring, except that, the same OC-12 STS can be dropped to different STSs in the various OC-3s. In an ordinary ring, the same time slot (for example m-1-1-1) is used all the way around the ring. In a ring-on-ring application, the time slot identification can change in each extension. The same VTG/VT will be used but the STS can change.

The OC-3 (VT level) cross-connections are:

- At CO-1: a-1-4:m-3-2-1

  The first VT in the second VTG is assigned between CO and CO-1. This slot will be used to transport the DS1 that will terminate on port a-1-4.

- At RT1-1: b-2-1:m-1-2-1

  The above DS1 will leave the system from port b-2-1 at RT1-1. The VTG/VT slot (-2-1) is set by the cross-connection at CO-1. Because OC-12 STS mb-1 is dropped to the first STS in this OC-3 extension (m-1), port b-2-1 is cross-connected to m-1-2-1.

- At RT2-2: m-2-2-1:m-2-2-1

  At RT2, time slot mb-1 is dropped to the second STS going to RT2-2 (m-2). The VT/VTG assignment remains -2-1. A VT pass-through cross-connection is needed to enable future DS1s to be dropped at RT2-2. If drops will never be needed, STS pass-through cross-connections can be used.

- At RT3-3: m-3-2-1:m-3-2-1

  The VT above must also be passed through RT3-3. As before, the VTG/VT is -2-1. The OC-12 time slot is dropped to the third STS in the OC-3 in this segment.

With these cross-connections, DS1s originating at any of the four OC-3 nodes can be terminated at any one of the others with VT cross-connections at those nodes only. The STS "pipe" is in place with the OC-12 cross-connections. As was the case with the example DS1, two VT drop cross-connections and two pass-through cross-connections are needed.

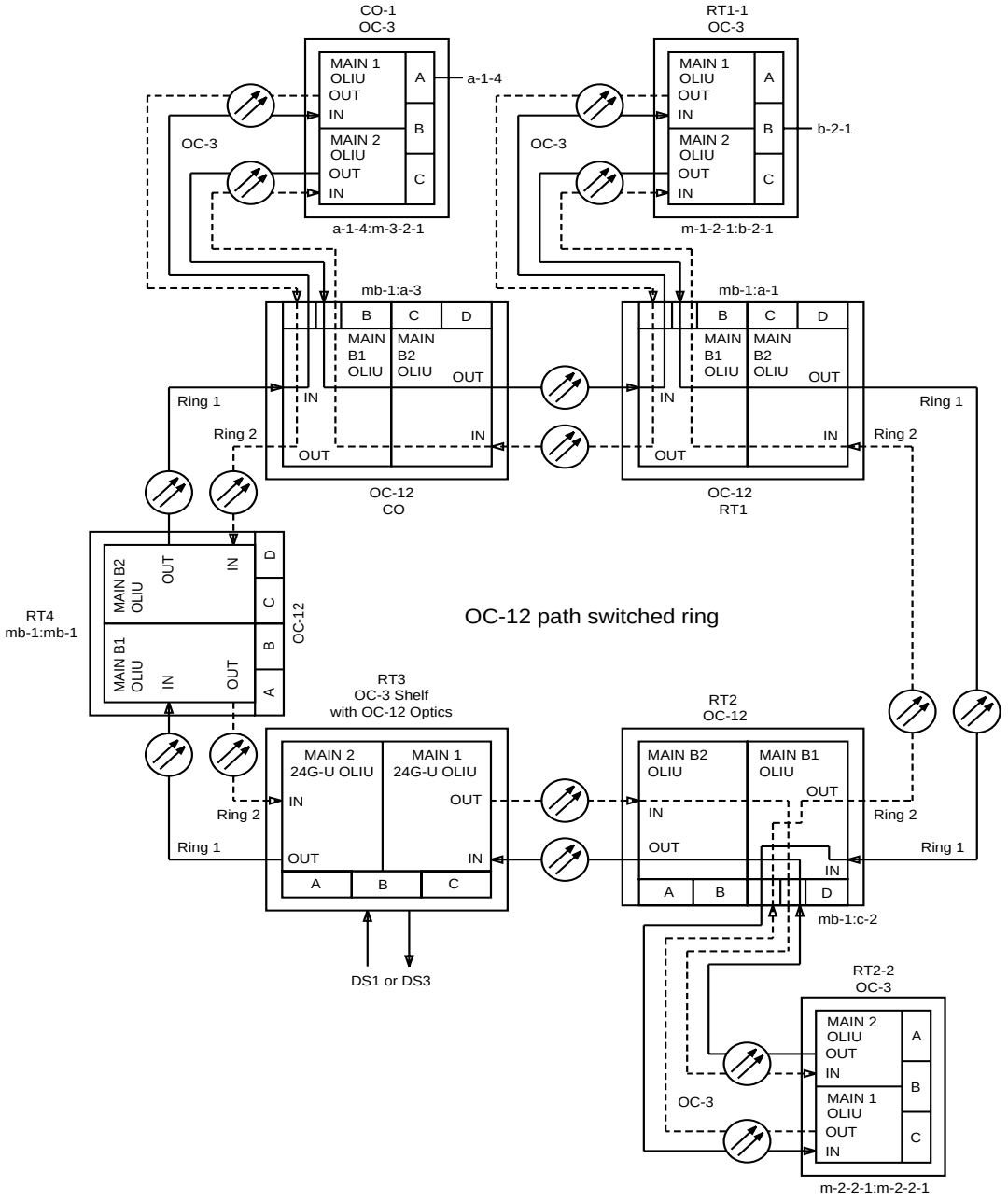


Figure 8-4. Example Single Homed OC-3/OC-12 Ring (0x1) Configuration Cross-Connections

Dual Homed OC-3/OC-12 VT1.5 Path Switched Ring (0x1)

Figure 8-5 is an example of an OC-3/OC-12 VT1.5 path switched ring (0x1) dual homed application. This application is similar to the single homed application except, for single homed 0x1 applications, both OC-12 function unit slots must be equipped while, for dual homed 0x1 applications, one OC-12 function unit slot must be empty (Node 5 slot 2 and Node 4 slot 1 in the example).

The DDM-2000 OC-12 ring supports ring (0x1) OC-3/IS-3 interfaces in its function unit slots. These interfaces must be provisioned as ring (0x1). Signals pass through the DDM-2000 OC-12 transport ring and exit to the DDM-2000 OC-3 ring. OC-12 function unit slot fn(A)-1 of Node 5 is connected to OC-3 main-1 and OC-12 function unit slot fn(A)-2 of Node 4 is connected to OC-3 main-2.

Protection switching is not done on the DDM-2000 OC-12 shelf for these lines or paths on these lines. VT1.5 or STS-1 level path switching is done on the DDM-2000 OC-3 Multiplexer shelf. In 0x1 operation, the OC-12 ring passes the contents of the STS-1 time slots between the OC-12 high-speed line and the low-speed OC-3/IS-3 lines without terminating or performing any line or path protection switching on them.

Example Cross-Connections

The OC-12 (STS level) cross-connections are:

- At Node 4: mb-1:a-1
- At Node 5: mb-1:a-1

The OC-3 (VT level) cross-connection is:

- At Node 1: b-2-1:m-1-2-1

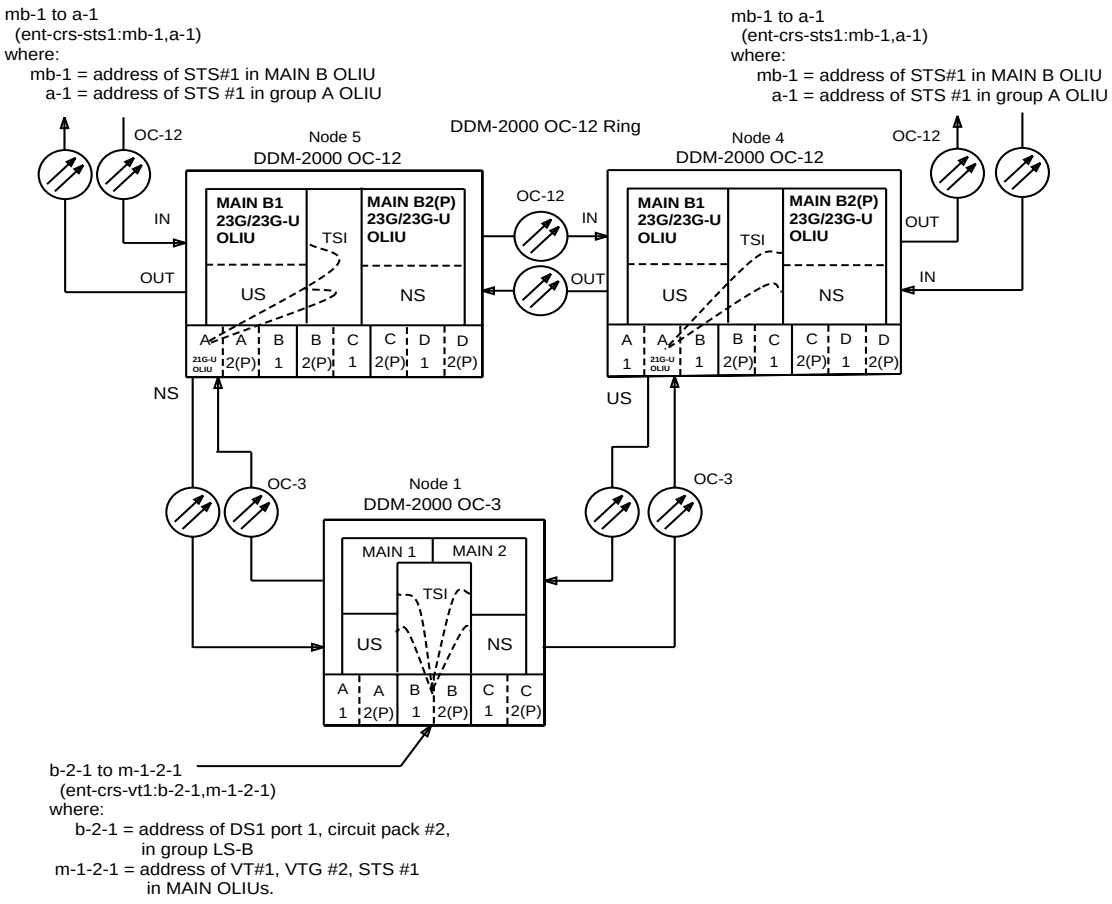


Figure 8-5. Example Dual Homed OC-3/OC-12 Ring (0x1) Cross-Connections

For dual homed applications, OLIUs must be installed in the proper slots at the OC-12 nodes to support the traffic direction that is required. For example, in Figure 8-6, a 21-type OLIU must be installed in Node 6 function unit b-2 allowing DS1 traffic from Node 1 to be routed to Node 6 when the proper cross-connections are made. At the DS1 drop point of the OC-3 ring, a 21-type OLIU must be installed in function unit b-1 of the OC-3 drop shelf.

Example Cross-Connections

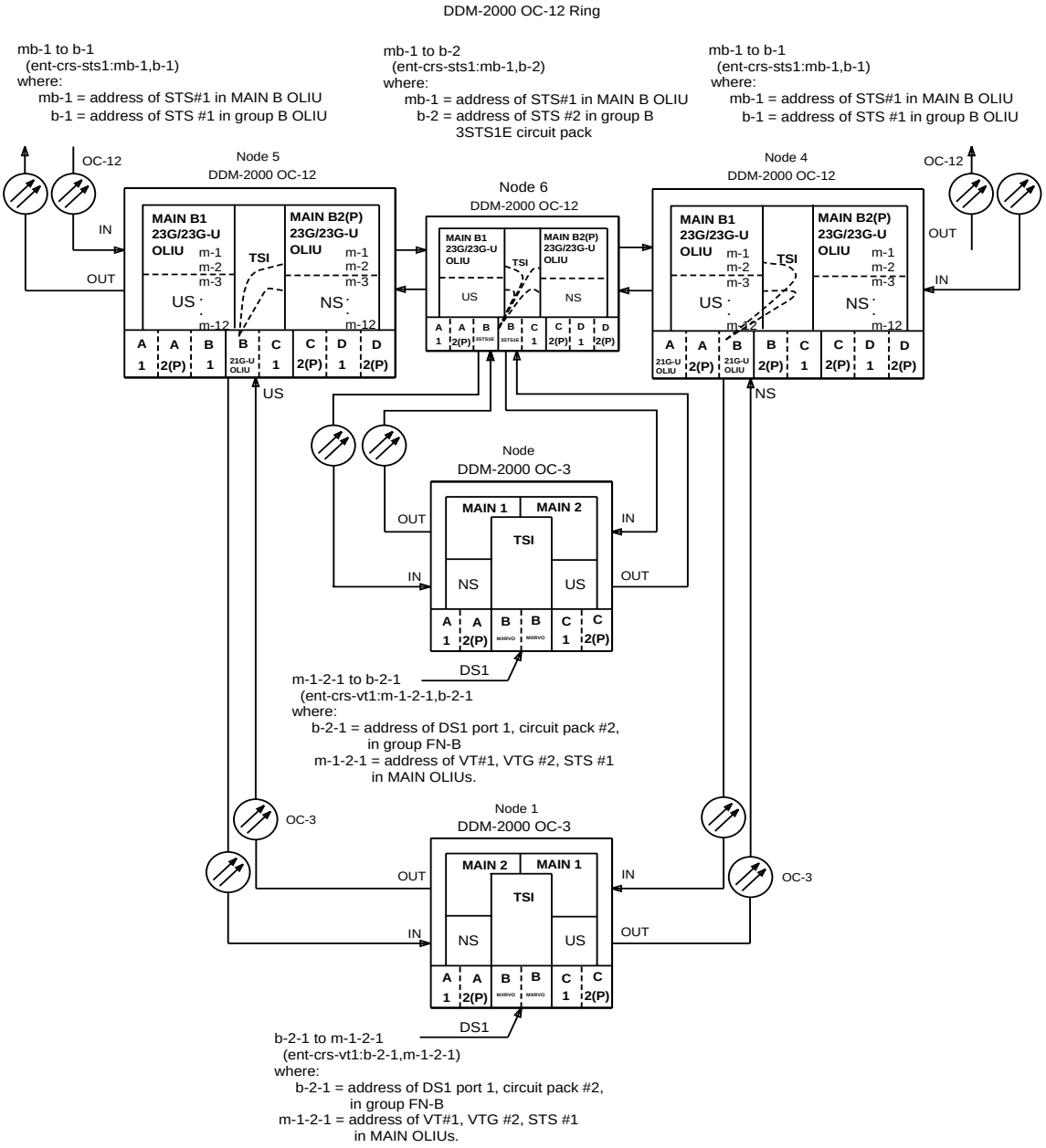
The OC-12 (STS level) cross-connections are:

- At Node 4: mb-1:b-1
- At Node 5: mb-1:b-1
- At Node 6: mb-1:b-2

The OC-3 (VT level) cross-connections are:

- At Node 1: b-2-1:m-1-2-1
- At Node 7: m-2-2-1:b-2-1

For more examples of OC-3/OC12 dual homing cross-connections, see the TOP (Volume II) section of this manual.



Note: In this configuration, pass-through cross-connects for mb-1, mb-2, and mb-3 are not needed at the upper OC-12 NEs (not shown).

Figure 8-6. Example Dual Homed OC-3/OC-12 Ring (0x1) Cross-Connections with Intermediate Node

Switch Selectable Parameters

Table 8-10 describes the parameters provisionable via hardware switches. Refer to the command pages in Section 11, "Commands and Reports," for a complete explanation of parameters. Additional information on the shelf and other parameters is provided in the "Identifiers" part immediately following Table 8-11.

Table 8-10. Parameters Provisionable via Hardware Switches

Parameter	Range	Pack	Command (Note)
Product ID (S1)	"Product Type"	SYSCTL	**rtrv-ne**
Optical transmitter power	high, low	21G/21G-U OLIU	**rtrv-oc3**
DS1 reference format *	SF, ESF	TG	**rtrv-sync**
DS1 reference line coding *	AMI,B8ZS	TG	**rtrv-sync**
Shelf timing mode	free-running, external DS1, line timed	TG	**rtrv-sync**
SYNC output LBO †	5 settings (cable dependent)	TG	**rtrv-sync**
DS1 Output	MULT/SYNC OUT	TG	**rtrv-sync**
3DS3 LBO	2 settings (cable dependent)	3DS3	
3STS1E LBO	2 settings (cable dependent)	3STS1E	

Note: Current switch settings except 3STS1E LBO, SYNC Output LBO, 3DS3 LBO, and TBOS termination can be reported using CIT.

* For both DS1 in and out.

† Operational only when in SYNC OUT mode.

Craft Interface Terminal (CIT) Selectable Parameters

Table 8-11 describes the parameters provisionable via the CIT. Refer to the command pages in Section 11, "Commands and Reports" for a complete explanation of parameters. Additional information on the ID parameter is provided in the “Identifiers” part immediately following Table 8-11.

Table 8-11. Parameters Provisionable via the CIT

Parameter	Range	Default (Note 1)	Command (Note 2)
Date* Time*	current value current value	70-01-01 00:00:00	**set-date** **set-date**
Target ID (system name) * Shelf number* CO/RT select* STS Uneqpd./AIS insert*	20 characters 1-8 CO, RT Uneqpd., AIS	Site#NE# 1 RT AIS	**set-ne** **set-ne** **set-ne** **set-ne**
CIT page length	0 (pager off), 3-150 rows	24	**set-link**
PM thresholds	See PM Table 10-14		**set-pmthres**
Alarm holdoff delay Alarm clear delay Power minor almn. level	0-30 sec 0-30 sec MN, MJ	2 15 MN	**set-attr-alm** **set-attr-alm** **set-attr-alm**
OC-3 degrade threshold OC-3 interface applications Sync Messaging AIS alm. level of NSA OC-3 Line AIS	10^{-5} — 10^{-9} 1+1, 0x1, video K byte, S byte, disabled CR, MJ, MN, NA	10^{-6} 0x1 K byte NA	**set-oc3** **set-oc3** **set-oc3/set-oc12** **set-oc3**
OC-3 line state	IS, NMON	IS	**set-state-oc3**
STS-1 signal degrade NSA STS-1 path AIS alarm level SA STS-1 path AIS alarm level	10^{-5} — 10^{-9} MN, NR CR, MN, NA, NR	10^{-6} MN MN	**set-sts1** **set-sts1** **set-sts1**
STS-1 channel state	NMON, AUTO †	AUTO †	**set-state-sts1**
STS-3c signal degrade threshold NSA STS-3c path AIS alarm level SA STS-3c path AIS alarm level	 10^{-5} to 10^{-9} MN, NR CR, NA	 10^{-6} MN CR	 **set-sts3c** **set-sts3c** **set-sts3c**

See notes and footnotes at end of table.

Table 8-11. Parameters Provisionable Via the CIT (Contd)

Parameter	Range	Default (Note 1)	Command (Note 2)
STS-3c channel state	AUTO, NMON	AUTO †	**set-state-sts3c**
OC-12 degrade threshold	10^{-5} — 10^{-9}	10^{-6}	**set-oc12**
AIS almn. level of NSA OC-12 line AIS	CR, MJ, MN, NA	NA	**set-oc12**
DS3 VMR mode	VMR, VM, clear channel	VMR	**set-t3**
Clear channel DS3 AIS insertion	yes, no	no	**set-t3**
DS3 signal failure alarm level	CR, MJ, MN, NA	NA	**set-t3**
DS3 failure threshold	10^{-3} , 10^{-6} BER	10^{-3}	**set-t3**
DS3 PM mode	off, on	on	**set-t3**
DS3 PM frame	m13, cbit	m13	**set-t3**
DS3 PM format	pbit, fmbit, cbit	pbit	**set-t3**
DS3 port state	NMON, AUTO†	AUTO †	**set-state-t3**
EC-1 alarm level	CR, MJ, MN, none	MJ	**set-ec1**
EC-1 BER failure threshold	10^{-3} , 10^{-6} BER	10^{-3}	**set-ec1**
EC-1 port state	NMON, AUTO †	AUTO †	**set-state-ec1**
Environmental alarm level	CR, MJ, MN, NA	MN	**set-attr-env**
Environmental alarm name	26 characters	environment No	**set-attr-env**
Environmental alarm type	10 characters	MISC	**set-attr-env**
Control point description	26 characters	control #	**set-attr-cont**
Far-end communication via DCC/ IAO LAN	enabled, disabled	enabled	**set-fecom**
DCC identity for OSI subnetworks	userside, networkside	See command pgs	**set-fecom**
CIT security	enabled, disabled, lockout	disabled	**set-secu**
CIT timeout (minutes)	0-120	15	**set-secu**
DCC security	enabled, disabled, lockout	disabled	**set-secu**
DCC timeout (minutes)	0-120	15	**set-secu**
SYNC mode switching	revertive, nonrevertive	revertive	**set-sync**
Sync Timing Source¶	main-b-1, main-b-2	main-b-1	**set-sync**
AIS Threshold	level 5, level 4, level 3, level 2	level 5	**set-sync**
Auto. Synch. Reconfig.	enabled, disabled	disabled	**set-sync**
Feature Package ‡ OC-3c (STS-3c)	enabled, disabled	disabled	**set-feat**
X.25 packet size*	128, 256	256	**set-x25**

See notes and footnotes at end of table.

.

Table 8-11. Parameters Provisionable Via the CIT (Contd)

Parameter	Range	Default (Note 1)	Command (Note 2)
L3org (Organization ID)*		000000	**ent-ulsdcc-l3**
L3res (Reserved)*	Refer to command pages of	0000	**ent-ulsdcc-l3**
L3rd (Routing Domain)*	ent-ulsdcc-l3 in “Section 11.”	0000	**ent-ulsdcc-l3**
L3area (Area within routing domain)*		0000	**ent-ulsdcc-l3**
L3lv2is (Level 2 router)*		disable	**ent-ulsdcc-l3**
L4lif (TARP lifetime parameter)*	1-65535	100	**ent-ulsdcc-l4**
L4aj-(x) (Manual adjacency parameters) *§	See the command pages of ent-ulsdcc-l4 in “Section 11.”	See command pgs.	**ent-ulsdcc-l4**
L4t(x)tm (TARP timer-parameters)*	See command pgs.	See command pgs.	**ent-ulsdcc-l4**
L4lftm (TARP loop detection buffer flush timer)*	1-1440	5 min	**ent-ulsdcc-l4**
L4etdc (Enable TARP data cache)*	enable, disable	enable	**ent-ulsdcc-l4**
L4tdc(x) (TARP data cache parameters)*§	See command pgs.	See command pgs.	**ent-ulsdcc-l4**
VC ckt. type X.25 attach.*	PVC, SVC	PVC tl1CR	**ent-osacmap**
SNPA: LCN for PVCs	LCN 1-9, DTE(15 digits)	LCN 1 (PVC) LCN 2 (PVC) tl1Maintenance LCN 3 (PVC) tl1Memory Administration	
or DTE address for SVC*	LCN 1-9, DTE(15 digits)	tl1PeerComm	**ent-osacmap**
OS type (ACID)*	See command pgs.		**ent-osacmap**
ACID (OS type or funct.)*	See command pgs.		**ent-tl1msgmap**
TL1 message type*	See command pgs.		**ent-tl1msgmap**
Action to assoc. message type to OS*	enabled, disabled	enabled	**ent-tl1msgmap**
Cross-connection type	twoway,dc	twoway	**ent-crs-sts1**
Ring ID for drop&continue	mb1, mb2	See command pgs	**ent-crs-sts1**
Cross-connection type	twoway,dc,cov,rtv	twoway	**ent-crs-sts3c**
Ring ID for drop&continue	mb1, mb2	See command pgs	**ent-crs-sts3c**
Outgoing STS-1 path trace message	62 characters	See command pgs	**set-trace-sts1**
Expected STS-1 path trace message	62 characters	See command pgs	**set-trace-sts1**

See notes and footnotes at end of table.

.

Notes

1. Default means factory default (the CIT prompts display current provisioned values).
2. To view the current values, precede these commands with •rtrv- instead of •set-.

* When security is enabled, this command is available to privileged users only (default is “disable”).

† AUTO means the port or channel is ready to be automatically provisioned via signal detection.

‡ This command is restricted to privileged users only.

¶ Setting this parameter also affects DS1 output source and sync output mode. See **`set-sync`** command in Section 11, Commands and Reports.

§ (X) indicates multiple parameters. See the command pages of ent-ulsdcc-l4.

Identifiers (IDs)

The following IDs are used for the shelf, target, CO/RT, NSAP address, and GNE. See also the *Lucent Technologies 2000 Product Family Multi-Vendor Operations Interworking Guide*, 824-102-144 and the *DDM-2000 Operations Systems Engineering Guide*, 824-102-151.

- **Shelf ID:** The shelf ID is a parameter with values of from 1 to 8. The shelf ID provides a convenient way to log into a selected shelf in a bay using the CIT. Therefore, each shelf (OC-3 or OC-12) in a bay must be assigned a unique shelf ID. The recommended numbering is to start at the bottom of the bay and assign the bottom shelf with a shelf ID of 1 and work up to the top of the bay.
- **TID:** The TID is a 20-character parameter that is set through the CIT using the **`set-ne`** command. The TID is used in the **`rlgn`** command to identify an NE to which a CIT remote login session is being established. The TID is also used by OSs to identify NEs using the TL1 message-based communications protocol.

  After the **`init-sys:all`** command is entered, the system sets the TID to a default value of LT-DDM-2000. The TID must be unique among all NEs. The default TID may be changed using the **`set-ne`** command to a unique user-assigned value recognized by the OS.
- **CO/RT:** The CO/RT parameter for CO or RT identifies the system as having the characteristics of a CO or RT. The default is RT. The parameter controls the operation of the miscellaneous discretes and the external fan control.
- **NSAP:** The NSAP is a multiple part address that uniquely identifies each NE. The NSAP is used for subnetwork DCC communications using the OSI protocol. The NSAP is set to unique values assigned to control hardware at the factory and does not have to be modified by the user unless subnetwork partitioning is necessary. Subnetwork partitioning is accomplished by assigning NEs to different areas. An NE's area address is one of the subfields within its NSAP. The **`ent-ulsdcc-l3`** command is used to modify an NE's NSAP.
- **GNE:** An NE that has an active TL1/X.25 link to an OS is automatically an GNE. Subnetworks can have multiple GNEs.

Performance Monitoring (PM) Parameters Provisionable via the CIT

For a list of PM parameters provisionable via the CIT, see Table 10-14 in the "Specifications" chapter of this manual.

Maintenance Description

9

Table of Contents

Overview 9-1

- Three-Tiered Operations 9-1

Single-Ended Maintenance Philosophy 9-4

- Multi-Vendor OI 9-6

In-service (IS) Upgrades 9-8

- Software Upgrades 9-8

DDM-2000 OC-3 and OC-12 Software Compatibility 9-9

Maintenance Signaling 9-10

Fault Detection, Isolation, and Reporting 9-16

- Detection 9-16
- Isolation 9-16
- Reporting 9-16

Protection Switching 9-17

- Automatic Line Protection 9-17
  - Status of ACTIVE LED on OLIUs 9-17
  - APS Initiation Criteria 9-18
- Equipment Protection 9-20
- Synchronization Reference Protection 9-20
- Path Protection Switching (Path Switched Rings) 9-21
  - Path Protection Scheme 9-22
  - Dual Ring Interworking (DRI) Path Protection Scheme 9-24
- OC-3/OC-12 Path Switched Ring (0x1) 9-26
  - Status of ACTIVE LED on Rings 9-26

Table of Contents

Loopbacks 9-26

Tests 9-27

- Transmission Tests 9-27
- Operations Interface Tests 9-27

Performance Monitoring (PM) 9-27

- DS3 Performance Monitoring (PM) 9-29
  - DS3 Path PM 9-29
  - DS3 Line Performance Monitoring 9-30
- DS3 Performance Monitoring Parameters 9-30
- Optical Parameters 9-33
  - Performance Monitoring (PM) Enabling 9-33
  - Laser Bias Current 9-33
  - Optical Transmit Power 9-33
- OC-3 and OC-12 Section Parameters 9-33
  - Performance Monitoring (PM) Enabling 9-33
  - Severely Errored Frame Seconds (SEFS) 9-33
- OC-3 and OC-12 Line Parameters 9-34
  - Performance Monitoring (PM) Enabling 9-34
  - Line Coding Violations (B2 Parity) 9-34
  - Errored Seconds (ES) 9-34
  - Severely Errored Seconds (SES) 9-34
  - Unavailable Seconds (UAS) 9-34
  - Line Protection Switch Counts 9-35
- EC-1 Line Parameters 9-35
  - Performance Monitoring Enabling 9-35
  - Line Coding Violations (B2 Parity) 9-35
  - Errored Seconds (ES) 9-35
  - Severely Errored Seconds (SES) 9-36
  - Unavailable Seconds (UAS) 9-36
  - Line Protection Switch Counts 9-36
- STS-1 Path Parameters 9-36
  - Performance Monitoring Enabling 9-36
  - STS-1 Path Coding Violations (B3 Parity) 9-36

Table of Contents

Errored Seconds (ES) 9-37
Severely Errored Seconds (SES) 9-37
Unavailable Seconds (UAS) 9-37
- DS3 Path Parameters 9-37
  - Performance Monitoring (PM) Enabling 9-37
  - CV-P Coding Violations 9-38
  - Severely Errored Frame Seconds (SEFS) 9-38
  - Errored Seconds (ES-P) 9-38
  - Severely Errored Seconds (SES-P) 9-38
  - Unavailable Seconds (UAS-P) 9-39
- DS3 Line Parameters 9-40
  - Coding Violations (CV-L) 9-40
  - Errored Seconds (ES-L) 9-40
  - Severely Errored Seconds (SES-L) 9-40
- Performance Monitoring Data Storage and Reports 9-40
- Performance Monitoring During Failed Conditions 9-40
- Performance Parameter Thresholds 9-40
- TCA Transmission to OS 9-41
- Performance Monitoring Reports 9-41
  - TCA Summary Report 9-41
  - Performance Status Reports 9-41

Reports 9-42
- Database Change Transmission to OS 9-42
- Alarms and Status Report 9-42
- Provisioning Reports 9-42
- Maintenance History Report 9-42
- State Reports 9-43
- Equipment Report 9-43
- Neighbor Map Report 9-43
- Network Map Report 9-43

Table of Contents

Maintenance Description

9

Overview

This section defines the "maintenance philosophy" outlining the various features available to monitor and maintain the DDM-2000 OC-12 Multiplexer. Specific trouble clearing and maintenance procedures are provided in the operation and maintenance (TOP) section of this manual (Volume II).

Three-Tiered Operations

Figure 9-1 shows the three-tiered operations procedures for the DDM-2000 OC-12 Multiplexer. The DDM-2000 OC-12 Multiplexer operations procedures are built on three levels of system information and control, spanning operations needs from summary-level status to detailed reporting.

The first operations tier consists of light-emitting diodes (LEDs) and pushbuttons on the user panel and circuit pack faceplates. These allow routine tasks to be performed without a craft interface terminal (CIT) or any test equipment. The user panel provides system-level alarm and status information for the local terminal. The circuit pack faceplate FAULT LEDs allow fast and easy fault isolation to a particular circuit pack. The user panel and equipment indicators are described in Chapter 6, “Operation Interfaces.”

The second operations tier provides access to DDM-2000 OC-12 Multiplexer operations from a CIT over an EIA-232-D interface. System details that cannot be obtained from the first operations tier alone can be obtained over the CIT interface. A VT-100 compatible terminal or terminal emulator software running on a personal computer (PC) can be used as a CIT. Command and prompt modes

are available with extensive on-line help features. The CIT interface supports operations, administration, maintenance, and provisioning (OAM&P) activities such as performance monitoring (PM), on any and all network elements (NE) in the SONET subnetwork from a single DDM-2000.

An optional graphical user interface and provisioning (CPro-2000) tool is also available. Using CPro-2000, which runs on an *MS-DOS** PC, a user can take advantage of the graphics to do many provisioning related activities. The DDM-2000 CIT and CPro-2000 are described in Chapter 6, “Operations Interfaces.”

The third operations tier consists of the remote OS interfaces. The OS interfaces include TL1/X.25 and an IAO LAN interface.

The DDM-2000 OC-12 Multiplexer supports a full-featured TL1/X.25 interface to multiple OSs. The DDM-2000 OC-12 Multiplexer supports alarm surveillance and PM with OSs, such as Bellcore's Network Monitoring and Analysis (NMA) OS.

The DDM-2000 OC-12 Multiplexer supports automated service provisioning with memory administration OSs, such as Bellcore's Operations System Intelligent Network Element (OPS/INE) and Lucent's ITM SNC. The DDM-2000 OC-12 Multiplexer also supports remote recovery and control functions, installation provisioning, and security over the TL1/X.25 link.

As an alternative to DDM-2000 serving as a TL1/X.25 GNE, ITM SNC R5.0 can serve as a TL1-GNE via an IAO LAN interface. DDM-2000’s TL1/X.25 and IAO LAN interfaces are described in Chapter 6, “Operations Interfaces.”

The *SLC*®-2000 Access System supports the same X.25 and IAO LAN interfaces and TL1 message set as the DDM-2000 OC-12 Multiplexer. The *SLC*-2000 Access System adds digital loop carrier (DLC) specific functionality to the existing TL1 messages (for example, for DLC related alarms) and in addition supports DLC specific TL1 commands (for example, DS0 level provisioning). See 363-208-000, *SLC-2000 Access System, Applications, Planning, and Ordering Guide*, for more information.

* Registered trademark of Microsoft Corporation.

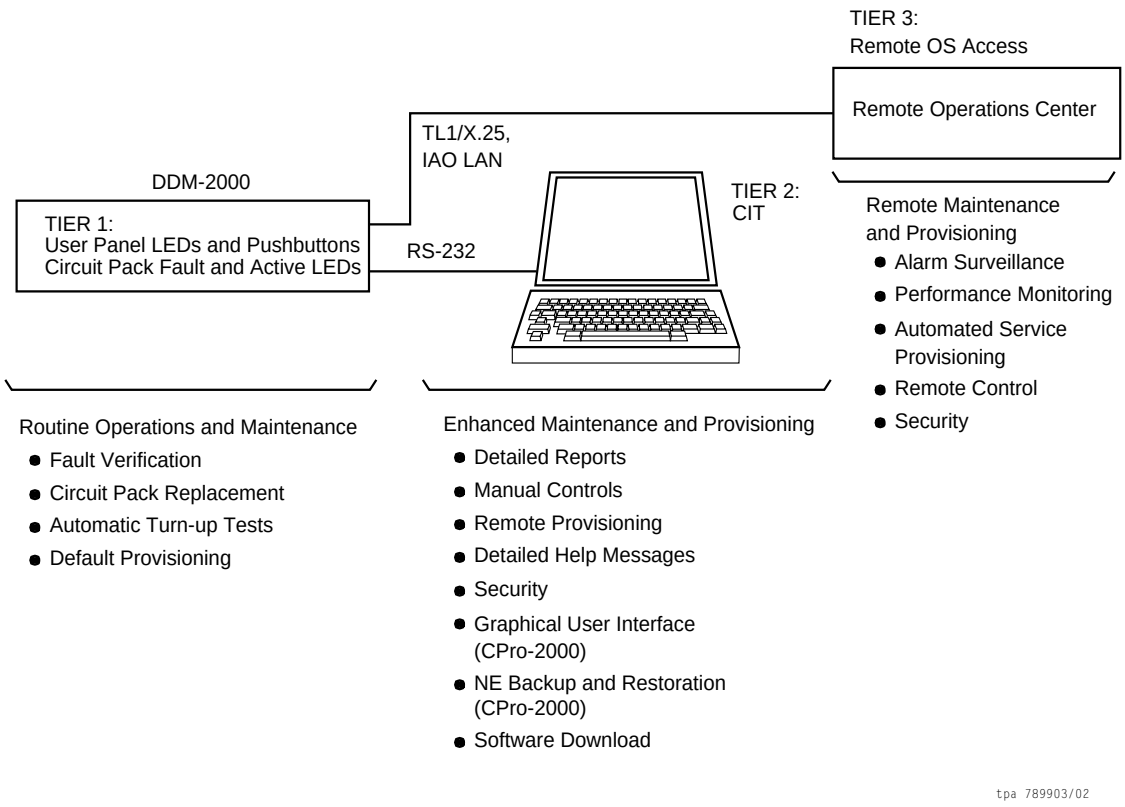


Figure 9-1. Three-Tiered Operations

Single-Ended Maintenance Philosophy

As a loop-optimized product, the DDM-2000 OC-12 Multiplexer allows operation and maintenance of all remote DDM-2000 NEs in a subnetwork from a DDM-2000 in a central office. A subnetwork consists of NEs interconnected by optical lines and/or an IAO LAN with the SONET data communications channel (DCC) enabled. Similarly, a technician working at a remote site can gain access to the central office (CO) DDM-2000 associated with that DDM-2000 OC-12 Multiplexer, as well as with other remote DDM-2000 Multiplexers in the same subnetwork. The DDM-2000 OC-12 Multiplexer uses the SONET DCC to provide CIT remote access, remote software downloads, and OS remote access. The DDM-2000 OC-12 Multiplexer uses the International Standards Organization (ISO) compliant open systems interconnection (OSI) protocol to communicate over the DCC.

Figure 9-2 shows the single-ended operations* (SEO) capability that provides remote access to all DDM-2000 systems in a subnetwork from a single DDM-2000 location. This minimizes technician travel because most maintenance, provisioning, and administration can be performed on all DDM-2000 Multiplexers in a subnetwork by accessing any DDM-2000 Multiplexer in the subnetwork. The SEO capability is provided by the DDM-2000 Multiplexers regardless of the subnetwork topology as long as DCC connectivity is available. The SEO (DCC) capability can be disabled between DDM-2000 shelves to create network maintenance boundaries (for example, interoffice applications) or for security reasons.

DDM-2000 OC-12 supports Lucent Technologies 2000 Product Family OI with DDM-2000 OC-3, FiberReach, *SLC*-2000, and FT-2000. It also supports multi-vendor OI in subnetworks with other-vendor NEs such as Tellabs *TITAN* 5500. See Section 2, "Applications," and Section 8, "Administration and Provisioning," for more information about OI.

* The terms single-ended maintenance and single-ended operations (SEO) are synonymous and have traditionally been used to refer to operations among DDM-2000 systems only. Now that SEO is supported among the 2000 Product Family NEs as well as in multi-vendor applications, the term operations interworking (OI) is more commonly used. OI among multi-vendor NEs will be covered later in this chapter.

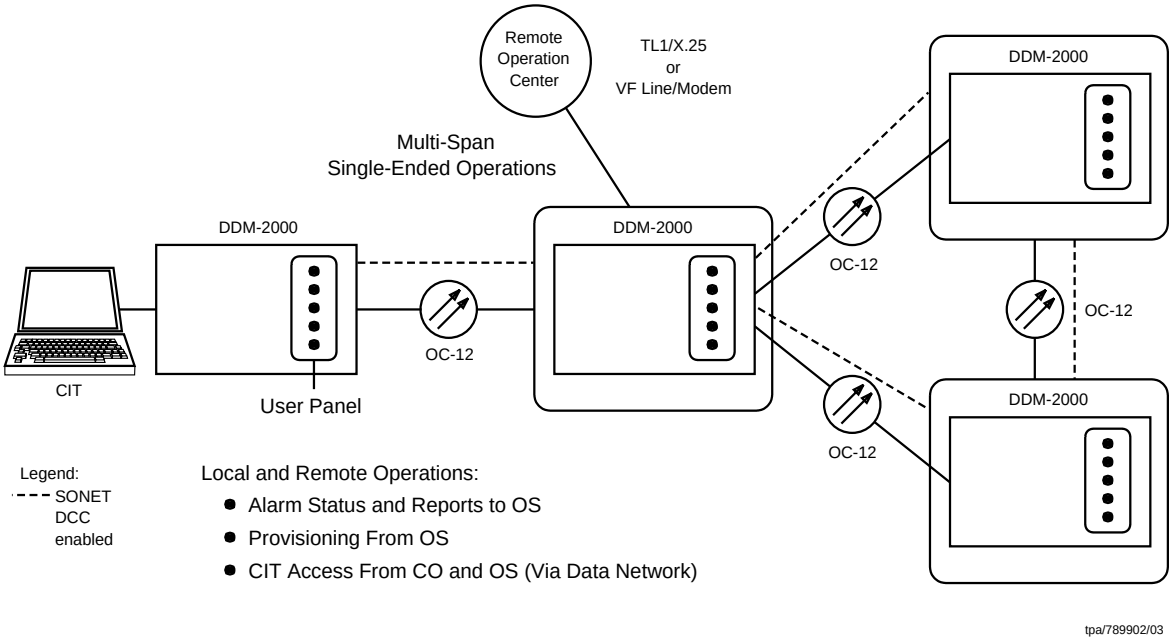


Figure 9-2. Single-Ended Operations

Multi-Vendor OI

To support multi-vendor OI, DDM-2000 OC-12 R7.0 and OC-3 R13.0 support Target ID Address Resolution Protocol (TARP) instead of Lucent Directory Service (LDS). DDM-2000 FiberReach R3.0 and FT-2000 OC-48 R8.0 also support TARP, thus Lucent 2000 Product Family OI compatibility is still supported but not OI compatibility with previous releases of DDM-2000 and FT-2000. Both LDS and TARP are directory services that provide NSAP-TID translations. LDS supports additional Lucent-only features, but TARP is the established multi-vendor standard for SONET NEs that support TL1 OS interfaces. DDM-2000 supports the TARP Data Cache (TDC) function to reduce the frequency of TARP propagation throughout the subnetwork and to improve performance. No DSNE is required for TARP.

DDM-2000 OC-12 R7.0 has been developed to be compatible with any other-vendor NEs that also support TARP, OSI, IAO LAN, and TL1/X.25 as specified in Bellcore GR-253. In addition, DDM-2000's TARP Manual Adjacency feature enables DDM-2000 to operate in networks that include CMISE-based NEs which may not support TARP propagation. DDM-2000 OC-12 R7.0 supports user provisioning of several OSI parameters to allow users to adjust their operations subnetwork, if necessary. For example, to support subnetwork partitioning of large subnetworks, DDM-2000 supports user provisioning of NSAP area addresses and level 2 Intermediate System (IS) functionality.

DDM-2000 OC-12 R7.0's compatibility with Tellabs *TITAN* * 5500 DCS R5.0, including TL1/X.25 OS access with *TITAN* 5500 DCS serving as the TL1-GNE for DDM-2000 TL1-RNEs, has been confirmed through cooperative joint testing between Lucent and Tellabs. DDM-2000's compatibility with some other-vendor NEs has also been tested by independent third-parties such as Bellcore on behalf of the SONET Interoperability Forum (SIF).

Because DDM-2000 OC-12 R7.0 is intended to facilitate OS-based centralized operations, and because TL1/X.25 OS access is the key standardized multi-vendor OI application, the following Remote NE Status features are not supported:

- Remote office alarms
- Remote CIT alarm reports
- Remote user panel indications
- TBOS
- Parallel telemetry

* *TITAN* is a trademark of Tellabs, Inc.

All of the above features depend on the proprietary exchange of information among Lucent NEs in a subnetwork, specifically the communication of each remote NE's alarm status to other NEs. Although the Remote NE Status features were supported in previous releases of DDM-2000, such Lucent-only operations features in multi-vendor subnetworks would not include other-vendor NEs, due to the lack of applicable standards, and thus would be incomplete.

DDM-2000 OC-12 R7.0 still supports the following Lucent proprietary OI applications between Lucent NEs in multi-vendor subnetworks:

- Remote Craft Interface Terminal (CIT) login
- Remote software download and copy
- Remote NE-to-NE automatic time/date synchronization at start-up.

For more information about DDM-2000 OC-12 R7.0 OI, refer to 824-102-144, *Lucent Technologies 2000 Product Family Multi-Vendor Operations Interworking Guide.*

In-service (IS) Upgrades

Software Upgrades

Table 9-1 lists the current software releases of the DDM-2000 OC-12 Multiplexer that can be directly upgraded inservice. Specific procedures for upgrades are provided in the TOP section of this manual (Volume II).

Table 9-1. DDM-2000 OC-12 In-service Software Upgrade Compatibility (Note)

	Upgrade to*		
Current Release	5.0.n	5.1/5.2	7.0†
3.1.n (Ring)	C	C	C
5.0.n (Ring)	X	X	X
5.1/5.2 (Ring)	NA	X	X
7.0 (Ring)	NA	NA	X

Note: All DDM-2000 OC-12 shelves in a subnetwork should be using the same version of software. An "n" is the latest point release available.

* When doing an upgrade, it is recommended that the latest point release of software be used, if possible.

† All nodes in a network must be upgraded to R7.0. Any nodes running earlier releases will be isolated until upgraded to R7.0.

C Requires an upgrade procedure with on-site equipment/fiber changes as well as software download to upgrade the system. Additional changes to software and equipment provisioning may be needed to use features of the new release. See TOP section of this manual (Volume II) for upgrade procedures.

X Requires local or remote software download only to upgrade the system.

NA Not Applicable. If an NA conversion is required, contact your local Technical Support Organization.

DDM-2000 OC-3 and OC-12 Software Compatibility

Table 9-2 lists the software compatibility within a subnetwork for the DDM-2000 OC-3 and OC-12 Multiplexers. All configurations listed support OI. The table lists all possible software combinations. Combinations not listed are not supported.

Table 9-2. DDM-2000 OC-3 and OC-12 Software Compatibility (Note)

OC-3 Release	OC-12 Release	Interconnection Method	Notes
13.0 *	7.0	22-type † or 21G/21G-U/ 21D/21D-U ‡, 24G-U § OLIU	Supports OC-3/OC-12 interworking, 0x1 interfaces, and DRI

Note: All NEs in a ring network, which may be part of a larger network, must be running the same software. In a subnetwork, all NEs must be running compatible software according to the table.

* 22-type OLIUs must be used in DDM-2000 OC-3 ring shelves in main and function unit slots for optical extensions. 21-type OLIUs are used in OC-12.

† The 22-type OLIUs can only be used in the DDM-2000 OC-3 shelf in place of the 21G/ 21G-U OLIU. The 22-type OLIUs cannot be used in the DDM-2000 OC-12 shelf.

‡ The 21D/21D-U OLIU can be used in the DDM-2000 OC-3 shelf in place of the 21G/ 21G-U OLIU for short-reach applications. The 21D/21D-U OLIU can be used in the DDM-2000 OC-12 shelf in place of the 21G/21G-U OLIU for short-reach applications.

§ 24G-U in main only (OC-3).

Table 9-3 lists the dual ring interworking (DRI) software compatibility for the DDM-2000 OC-12 Multiplexer for both EC-1 and OC-3 interfaces. The table lists all possible software combinations. Combinations not listed are not supported.

Table 9-3. DDM-2000 OC-3 Multiplexer DRI Software Compatibility

DDM-2000 OC-3	DDM-2000 OC-12 and FT-2000
Release 13.0	OC-12 Release 7.0 and FT-2000 Releases 8.0

See 824-102-144, *Lucent Technologies 2000 Product Family Multi-Vendor Operations Interworking Guide,* for more information on operations interworking.

Maintenance Signaling

The DDM-2000 OC-12 Multiplexer provides maintenance signaling compliant with the SONET standard (TR-253). The DDM-2000 OC-12 Multiplexer inserts and detects the following alarm indication signals (AISs), which notify downstream equipment that a failure has been detected and alarmed by some upstream equipment:

- SONET line AIS
- STS-1 path AIS
- DS3 AIS.

The DDM-2000 OC-12 Multiplexer also inserts and detects the following signals, which notify upstream equipment of a failure detected downstream:

- Line far-end-receive failure (FERF)
- STS-1 path yellow.

The DDM-2000 OC-12 Multiplexer also inserts and detects STS unequipped signals. Figure 9-3 is an example of the AIS, yellow, and FERF signals generated in response to an unprotected incoming OC-12 line failure.

Figure 9-4 shows maintenance signals used by the DDM-2000 OC-12 Multiplexer in an STS path switched ring application. In this figure, the labels on the arrows pointing into the DDM-2000 OC-12 Multiplexer indicate the maintenance signals and failure conditions recognized by the DDM-2000 OC-12 Multiplexer. The labels on the arrows pointing out of the DDM-2000 OC-12 Multiplexer indicate the signals generated by the DDM-2000 OC-12 Multiplexer in response to the indicated incoming signals or failure conditions. The Xs indicate points of failure, either within the DDM-2000 OC-12 Multiplexer or in upstream equipment. Unlabeled arrows indicate normal transmission.

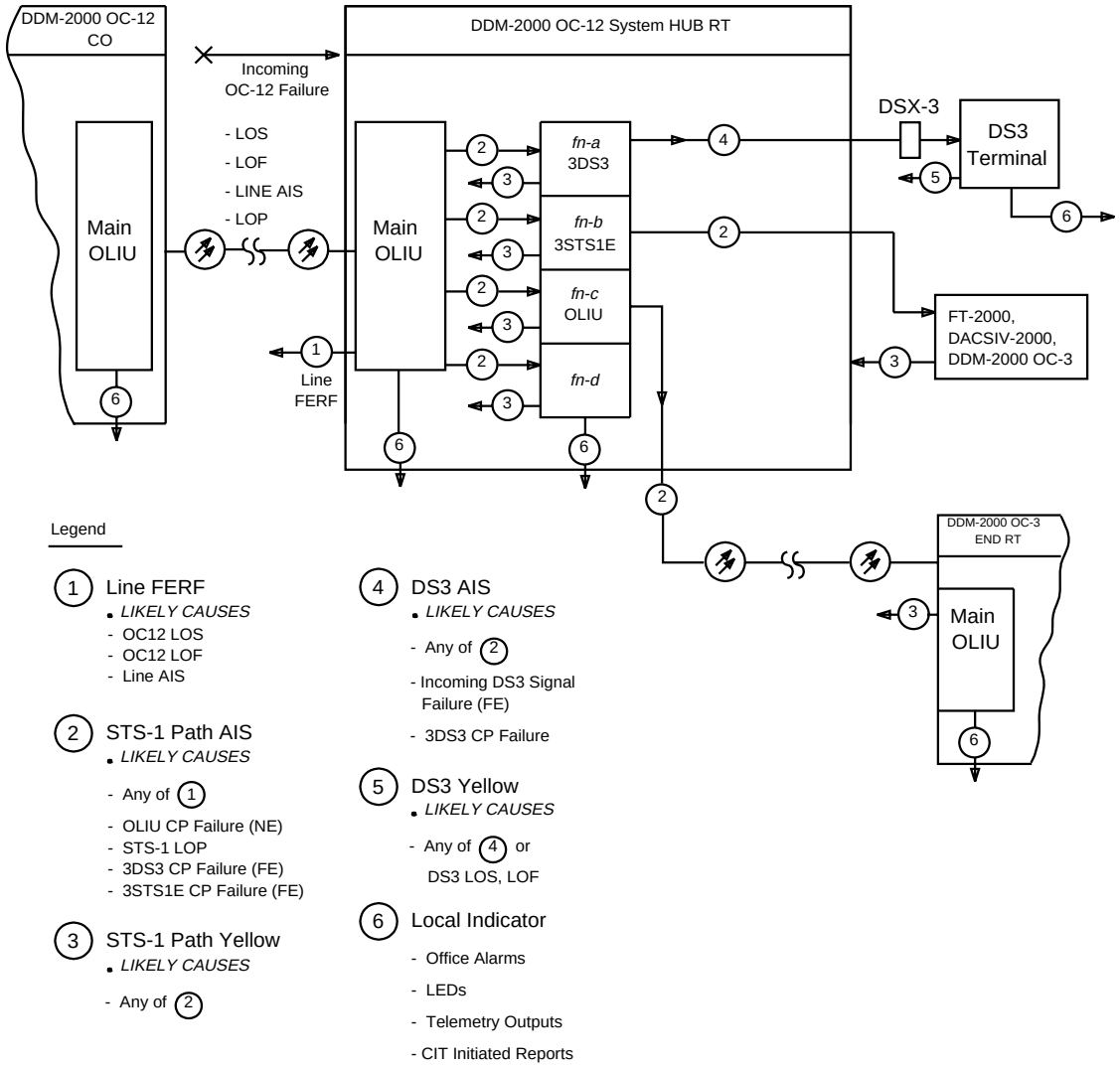
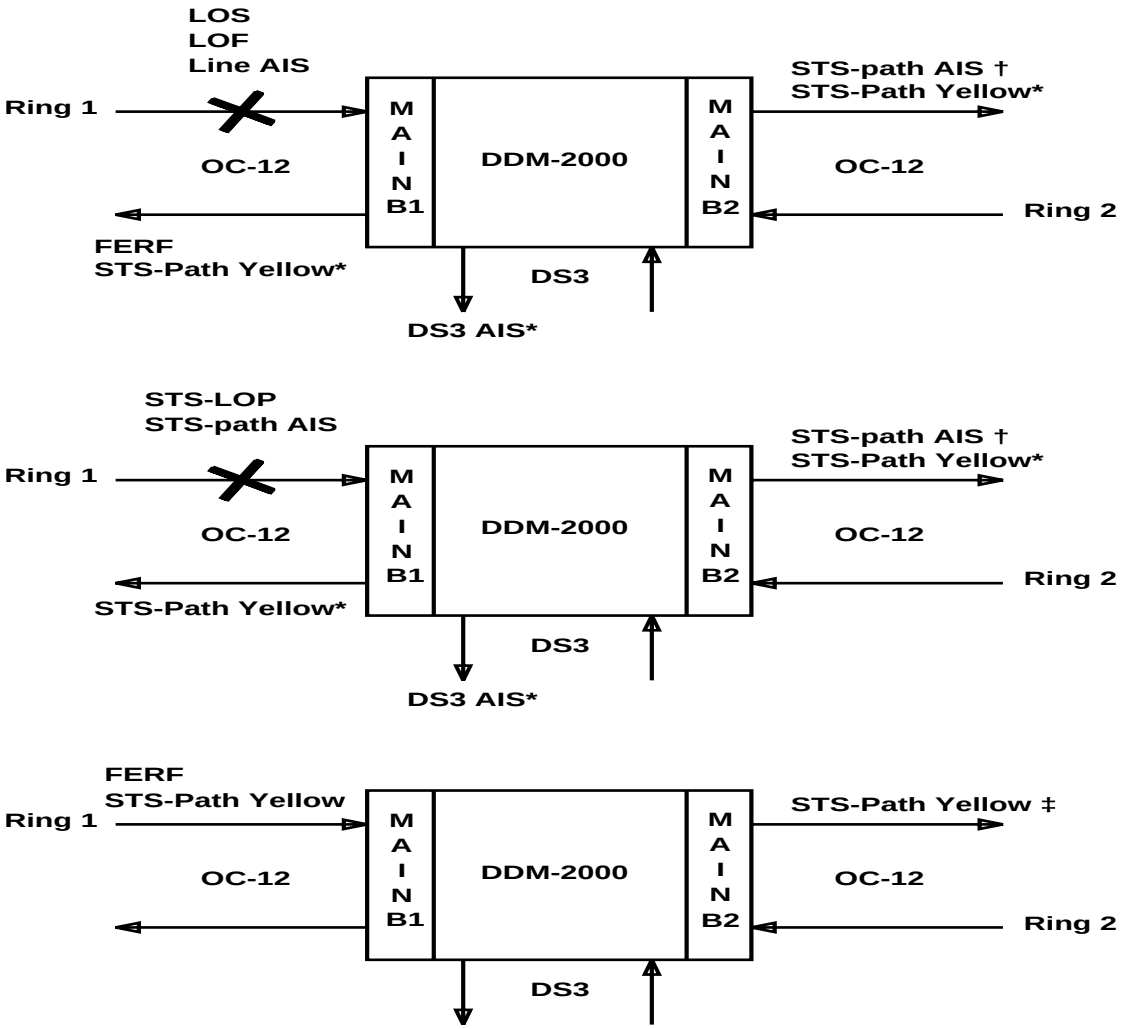


Figure 9-3. Example of Main Signal as a Result of Unprotected Incoming OC-12 Failure



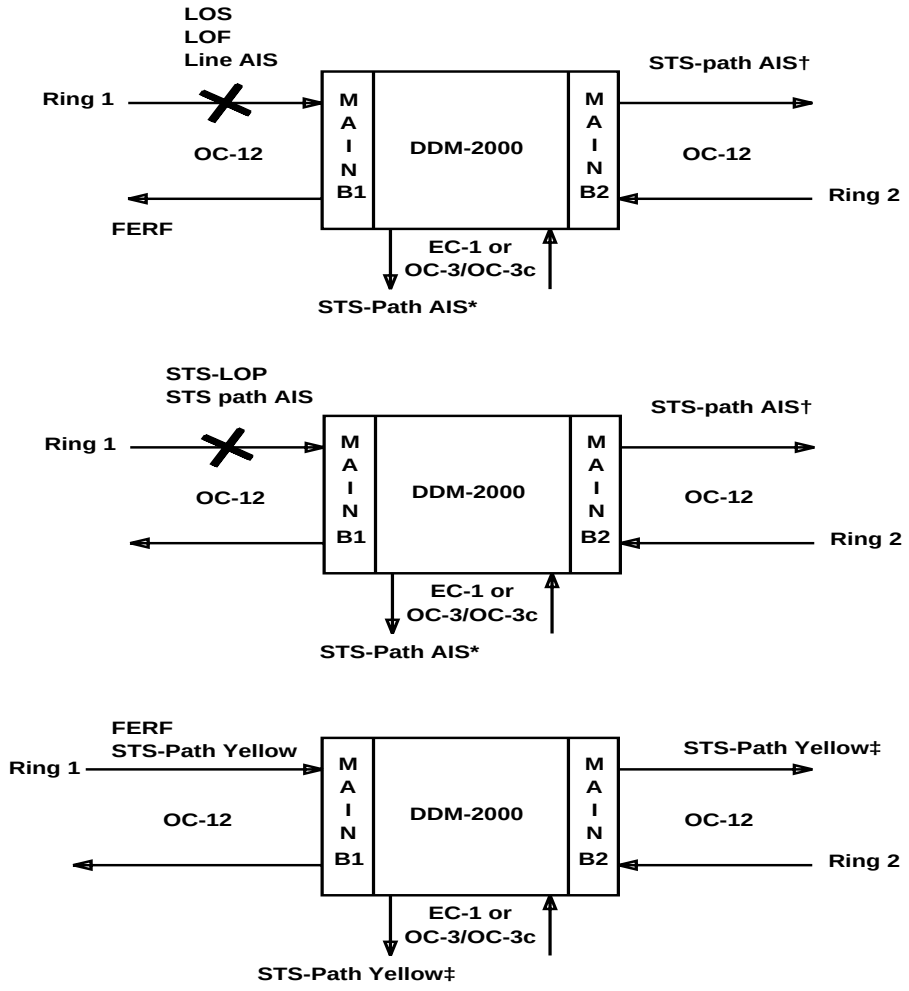
* STS-path yellow, DS3 AIS and STS-path AIS are sent on STS-1 paths selected from the failed ring (ring 1)

† STS-path AIS is sent on pass-through and continue paths only

‡ STS path yellow appears on pass-through and continue paths only

§ STS path yellow is passed to the EC-1 or OC-12 interface depending on whether the STS-1 path is a drop or pass-through connection

Figure 9-4. Maintenance Signaling — Path Switched Ring Applications (Sheet 1 of 4)

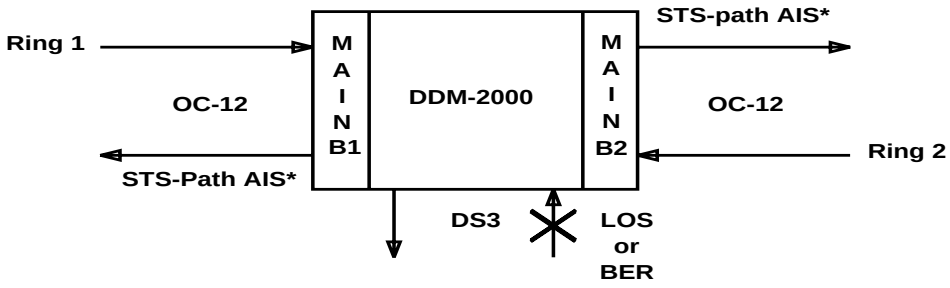


*** Signal is sent on STS-1 paths selected from the failed ring (ring 1)**

† Signal is sent on pass-through and continue paths only

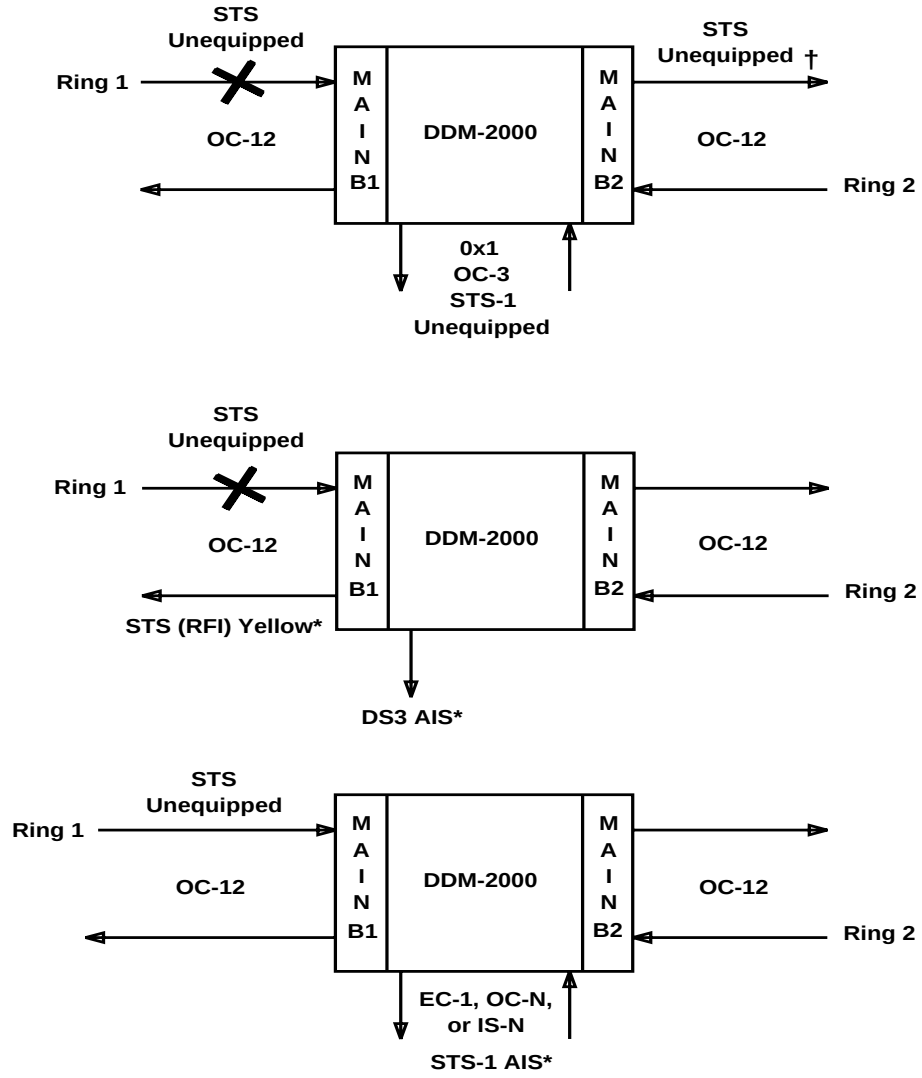
‡ STS path yellow is passed to the EC-1 or OC-12 interface depending on whether the STS-1 path is a drop or pass-through connection

Figure 9-4. Maintenance Signaling — Path Switched Ring Applications (Sheet 2 of 4)



* The incoming DS3 failure causes insertion of STS path AIS only if the DS3 ring interface has been provisioned for dual ring interworking (DRI)

Figure 9-4. Maintenance Signaling — Path Switched Ring Applications (Sheet 3 of 4)



*** Signal is sent on STS-1 paths selected from the failed ring (ring 1)**

† Signal is sent on pass-through and continue paths only

Figure 9-4. Maintenance Signaling — Path Switched Ring Applications — STS-Unequipped (Sheet 4 of 4)

Fault Detection, Isolation, and Reporting

Detection

The DDM-2000 OC-12 Multiplexer continuously monitors all circuit packs and incoming signals for faults. Incoming SONET signals are monitored for loss of signal (LOS), loss of frame (LOF), loss of pointer (LOP), and bit error ratio (BER) thresholds, and for the maintenance signals described above. Incoming DS3 signals are monitored for LOS and BER thresholds. The BER thresholds for DS3 are based on bipolar 3-zero substitution (B3ZS) coding violations. The DS3 signals received from the fiber are monitored for AIS and out of frame (OOF) conditions, unless they are provisioned for clear channel (CC) mode. DS1 timing references are monitored for AIS, BER, excessive out of frame (EOOF), LOF, LOS, and out of lock (OOL) conditions.

Isolation

When a fault is detected, the DDM-2000 OC-12 Multiplexer uses automatic diagnostics to isolate the fault to a particular signal or circuit pack.

Reporting

The system automatically and autonomously reports all alarm and status conditions through the appropriate user panel and equipment indicators, office alarm relays, and through the TL1/X.25 interface. The system stores a record of all fault conditions and reports them on demand through the CIT and the TL1/X.25 interface. The DDM-2000 OC-12 Multiplexer also stores a history of the past 500 alarm and status conditions and CIT events and reports them on demand through the CIT interface. Each event is real time and date stamped.

If the diagnostic determines that a circuit pack has failed, the red FAULT LED on that circuit pack is turned on. If an incoming electrical signal from the DSX fails, the red FAULT LED on the affected circuit pack flashes on and off in one-second intervals. A failed incoming optical signal has the same effect.

The DDM-2000 OC-12 Multiplexer provides alarm holdoff and clear delays. The alarm holdoff delays prevent transient failures from causing unnecessary maintenance activity. The office alarms are not activated and the OSs are not notified until a failure lasts at least as long as the alarm holdoff delay. Alarm clear delays prevent premature clearing of alarms. Alarm indications are not cleared until a fault condition has been clear for at least as long as the alarm clear delay. Incoming signal failure conditions, AIS, and FERF signals, are subject to the

provisionable holdoff delay and a fixed 15-second clear delay. Yellow signals are not subject to holdoff or clear delays. Circuit pack failures (except control circuit pack failures) are subject to the provisionable holdoff and clear delays. Refer to the **`set-attr-alm`** and **`rtrv-attr-alm`** commands in Section 11, "Commands and Reports."

Protection Switching

The DDM-2000 OC-12 Multiplexer provides equipment protection switching of all transmission and synchronization circuit packs and uses SONET standard automatic protection switching for the OC-3 and OC-12 lines. Installation of protection switching equipment is optional. Protection switching occurs in response to automatically detected faults in the circuit packs or OC-3 and OC-12 lines as well as external commands from a technician at a local/remote CIT or TL1/X.25 message-based OS interface. The DDM-2000 OC-12 Multiplexer uses SONET protection switching priorities for all transmission protection groups. Refer to the **`switch-line`**, **`switch-fn`**, **`switch-sync`**, and **`switch-tsi`** commands in Section 11, "Commands and Reports."

Automatic Line Protection

The DDM-2000 OC-12 Multiplexer uses the optional SONET 1+1 unidirectional nonrevertive automatic protection switch (APS) procedures. This means that after a cut service fiber is repaired, a location **does not** switch back (revert) and select the service set as its active fiber/OLIU set.

Status of ACTIVE LED on OLIUs

Figure 9-5 illustrates examples of unidirectional and nonrevertive line protection switches. Note the squares at locations A and C. Each square represents the transmit or receive section of an OLIU. Figure 9-5(a) and Figure 9-5(b) are associated with the Service (S) OLIU and Figure 9-5(d) and Figure 9-5(e) with the Protection (P) OLIU. Four optical fibers are associated with the Service and Protection OLIUs that interconnect the OLIUs at locations A and C. The two fibers connecting the Service OLIUs are the service fibers, and the two fibers connecting the Protection OLIUs are the protection fibers. Fibers and OLIUs shown in **bold** are active and carrying service.

In Figure 9-5(a), transmitted optical signals in each direction are permanently bridged to the service and protection fibers. The same signal is transmitted on both fibers. Each service and protection fiber and its associated OLIU are monitored as a set. The fiber/OLIU set selected by the receiving location is the active set and the ACTIVE LED, which in Figure 9-5(a) is on the service OLIU circuit packs, is lit. The fiber/OLIU set not selected is the standby set, and the ACTIVE LED on its corresponding OLIU is not lighted.

Contrary to other transmission circuit packs, ACTIVE LEDs on both OLIUs may be lit at the same time on the same shelf. For example, in Figure 9-5(b) the receive fiber going to location C has been cut. Location C selects the protection fiber/ OLIU set as active, resulting in the lighting of ACTIVE LEDs on both the OLIUs at location C. Location A did not switch to its protection set but continues to remain on the service set. This example illustrates the SONET standard of unidirectional APS. Since each location sends APS information to the other end, both ACTIVE LEDs on the OLIUs at location A are also lit.

After the cut service fiber is repaired, location C **will not** switch back (revert) and select the service set as its active fiber/OLIU set. This example, Figure 9-5(c), illustrates the SONET standard of nonrevertive APS.

Figure 9-5(d) and Figure 9-5(e) illustrate a second fiber failure and the resulting changes to the active OLIUs, thus showing that both protection sets could be active and carrying service.

APS Initiation Criteria

The APS is initiated by signal fail and signal degrade conditions on the received optical signal. The BER of the received optical signal is calculated from violations in the SONET line overhead B2 parity bytes. Signal fail is declared for:

- Incoming OC-12 LOS
- OC-12 LOF
- OC-12 Line AIS
- OC-12 BER exceeding 10^{-3}.

An OC-12 BER exceeding a provisionable 10^{-5} to 10^{-9} threshold causes the signal degrade condition. An APS is completed within 60 milliseconds of the beginning of a hard failure such as a fiber cut.

The DDM-2000 OC-12 Multiplexer APS is "span independent." In multispan applications, such as hubbing, an automatic or manual protection switch on one span does not cause a protection switch on any other span.

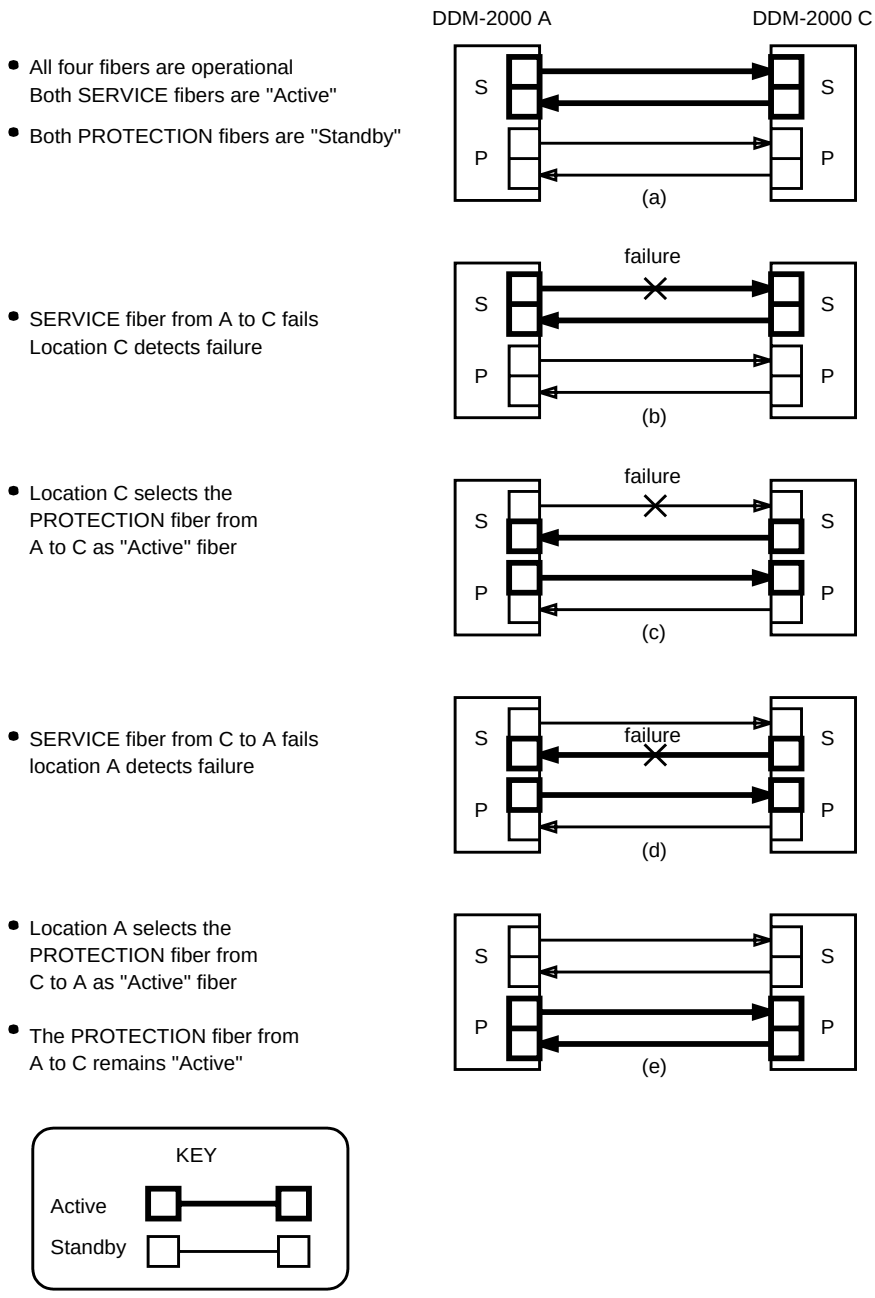


Figure 9-5. Unidirectional Line Protection Switching

Equipment Protection

The 3DS3, 3STS1E, BCP3 TSI, and TG circuit packs are 1x1 protected and use nonrevertive switching. Green ACTIVE LEDs are provided on the faceplates of these circuit packs to indicate which circuit packs are active (carrying service).

Synchronization Reference Protection

In external timing and line-timing modes, the synchronization references are 1×1 protected. If neither reference is available, the system automatically switches to "holdover" timing mode.

When the TG is provisioned for synchronization messaging, the system can determine the quality of the line-timing references by reading the synchronization messages in the OC-12 transport overhead bytes. If the quality is not adequate, the TG will switch to holdover until manually switched to a good reference.

If automatic synchronization reconfiguration is enabled, the TG will automatically select the highest quality reference. See "Synchronization Messaging" in Section 5, "Transmission and Synchronization Interfaces," and the **`set-sync`** command in Section 11, "Commands and Reports."

The system can be provisioned to revertive or nonrevertive timing mode switching. The default is revertive. If provisioned for revertive mode switching, the system automatically switches from holdover mode to the provisioned timing mode (external timing or line-timing) when an unprotected timing reference failure clears. If provisioned for nonrevertive mode switching, the system must be manually switched from holdover mode to the provisioned timing mode (external timing or line-timing) when an unprotected timing reference failure clears. Refer to the **`rtrv-sync`**, **`set-sync`**, and **`switch-sync`** commands in Section 11, "Commands and Reports."

Path Protection Switching (Path Switched Rings)

The path switched ring application is based on the Bellcore TR-TSY-000496/ GR-1400 path protection switching scheme.

The path protection switched ring has two single-fiber, counter-rotating rings as shown in Figure 9-6. This architecture has distinct advantages over a linear architecture. Each node on the ring terminates four fibers: a transmit and receive fiber in each direction. Eight fibers are needed to connect the same NE in a nonterminal position of a linear add/drop 1+1 protected arrangement: two transmit and two receive in each direction, without providing the same level of protection that the ring provides. The architecture of the ring is designed to protect against any single point of failure, including a node failure, single fiber cut, or dual fiber cut. Node failure or dual fiber failure in a linear network affects traffic to all downstream nodes. A node failure in a ring only affects traffic dropped at the failed node.

The DDM-2000 OC-12 ring provides STS-1 path protection switching to support DS3, EC-1, and OC-3/IS-3 interfaces.

The signal that enters the ring is protected on a SONET path basis as switching is performed independently for each path. Because of the ring's unidirectional operation, time slots must be reserved all the way around the ring for all ring traffic, limiting the capacity of the ring to the OC-N line rate.

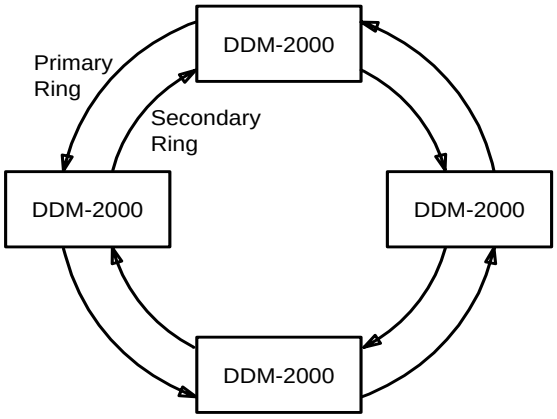


Figure 9-6. Two-Fiber Unidirectional Ring

Path Protection Scheme

Path protection rings feed a SONET payload (STS) from the ring entry point, simultaneously in both rotations of the ring, to the signal's ring exit point as shown by traffic AC and CA in Figure 9-7(a). This duplication of the signal that enters the ring is called a "head-end bridge." The node that terminates the signal from the ring monitors both ring rotations and is responsible for selecting the signal that has the highest quality based on LOS/LOF, path AIS, LOP, path unequipped and path BER performance. This function at the ring exit point is called a "tail-end switch." Path switching is nonrevertive. On pass-through paths, detected hard failures (LOS, LOF, LOP, line AIS, and STS-1 path AIS) result in path AIS insertion in the outgoing signals. This allows the terminating node to detect path failure and switch to protection.

Under normal conditions, both incoming SONET path signals to the switch selection point are of high quality, and the signal can be selected from either ring. A failure or a transmission degradation on one of the rings requires that the other ring path be selected, and requirements specify that this path selection must occur within 60 milliseconds after a hard failure condition. Figure 9-7(b) shows how traffic is switched when a dual-fiber cut occurs. Nonrevertive switching is provided to minimize the impact on critical customer services by giving the service provider control when, and if, the critical service should revert to a particular ring. A manual path protection switching command allows switching back to the original path for ease of ring maintenance. Refer to the **`switch-path`** commands in Section 11, "Commands and Reports."

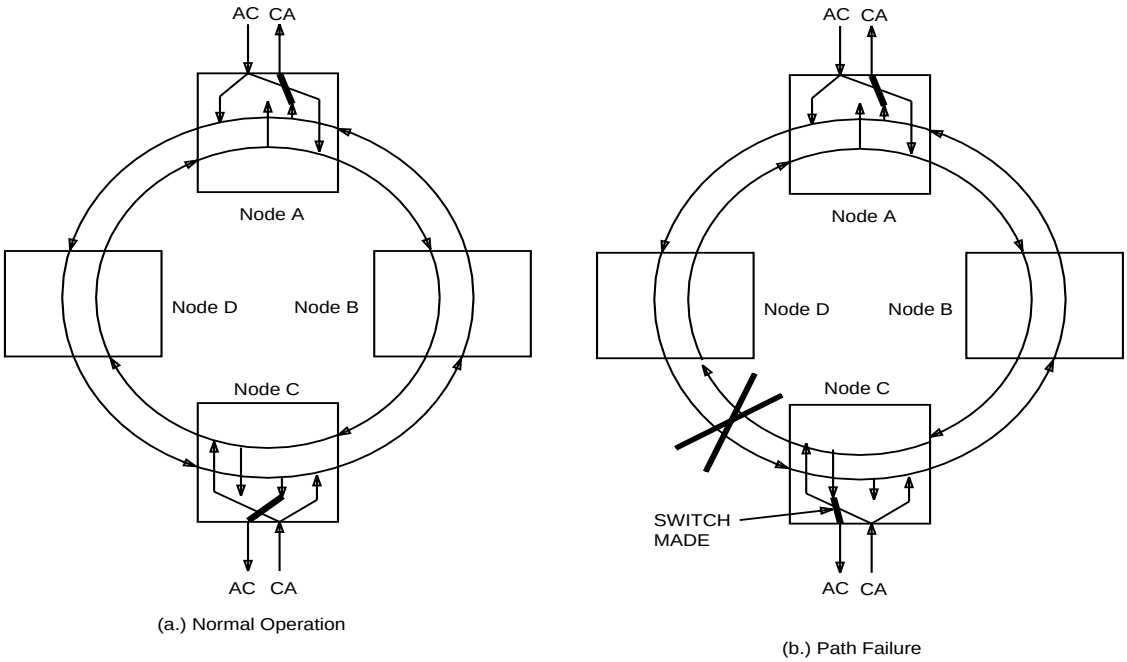


Figure 9-7. Path Protection Switching

Dual Ring Interworking (DRI) Path Protection Scheme

Interconnected rings or DRI is a topology that connects two rings together at two geographically separate nodes to provide an alternate route if a catastrophic failure occurs at one of the interconnecting nodes. See Section 2, "Applications," for more information on DRI. Figure 9-8 shows DRI path protection switching. Note that the upper ring could be an FT-2000 OC-48 Lightwave System bidirectional line switched ring. In the receive direction, a DRI node that passes a signal between rings performs two steps:

1. VT1.5 and/or STS-1 signals to be passed between rings are "dropped and continued." This means the signal is dropped at that node to the Function Unit and simultaneously copied into the OC-3/OC-12 signal in the outgoing direction of the same ring rotation.
2. The VT1.5 and/or STS-1 signal that was dropped in Step 1 and the corresponding VT1.5 and/or STS-1 signal incoming from the other ring direction are compared, and the signal with the highest quality is selected as in single ring topologies.

In the transmit direction, a DRI node feeds VT1.5 or STS-1 signals in the direction opposite to the "continue" portion of the drop and continue signal (Step 1 previously) to only one rotation of the ring as shown in Figure 9-8.

This routing is to only one rotation or "disabled bridge" as distinguished from how an ordinary path switched ring bridges incoming low-speed traffic onto both rotations.

The drop and continue disabled bridge routing necessary for DRI is established with a cross-connection command.

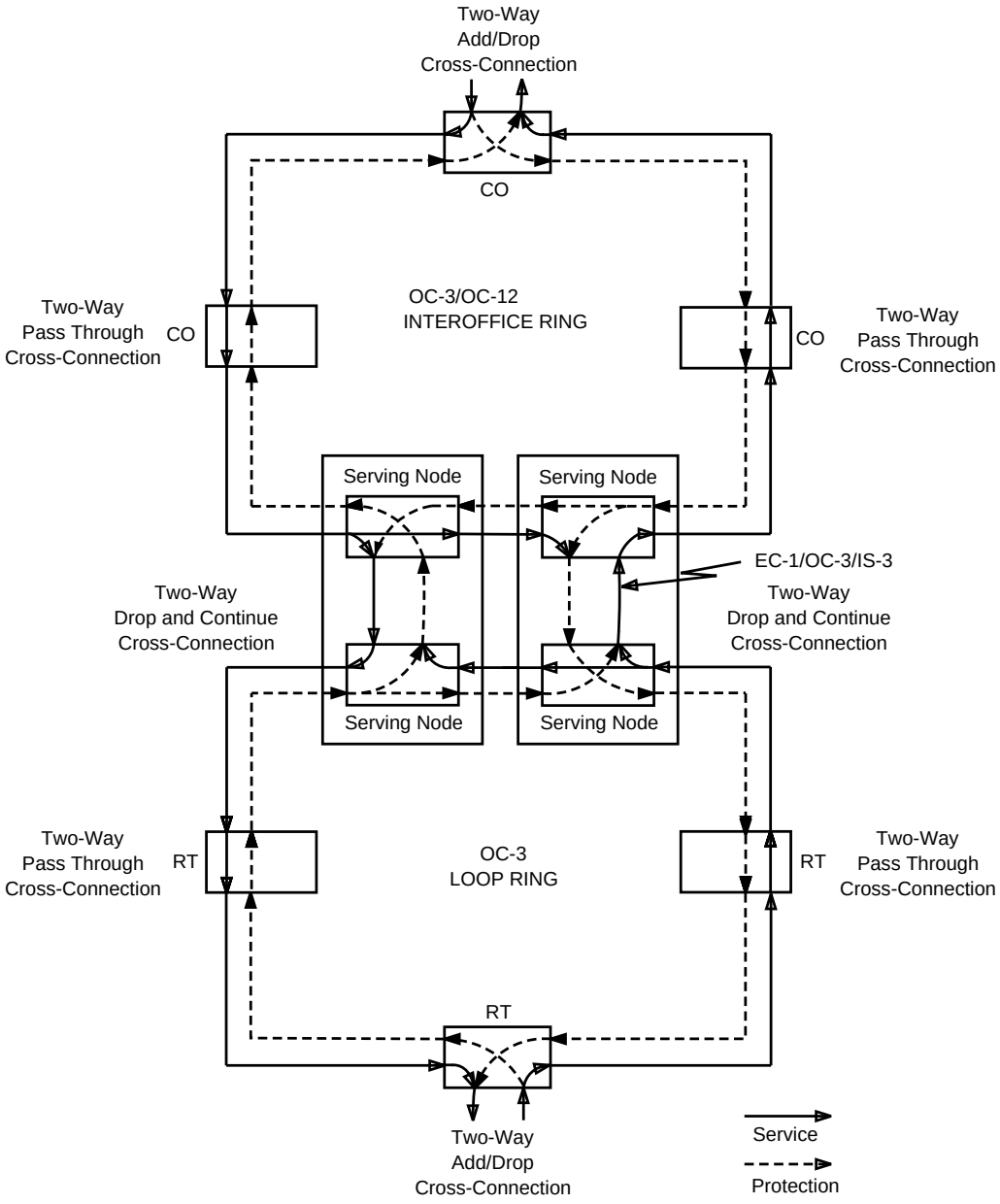


Figure 9-8. DRI Path Protection Switching

OC-3/OC-12 Path Switched Ring (0x1)

A DDM-2000 OC-3 ring shelf can function in a ring-on-ring application using the 0x1 interface capability of the OC-12 or FT-2000 OC-48 Lightwave System ring. The OC-3 shelf functions in the normal path switched ring mode. VT/STS path protection switching is done on the OC-3 shelf.

In single homing, the OC-3 ring shelf interconnects through its main-1/main-2 ring interface either directly or through another OC-3 ring shelf to the low-speed OC-3 0x1 interface on a single OC-12 or FT-2000 OC-48 Lightwave System shelf.

In dual homing, the OC-3 ring shelf interconnects directly or through another OC-3 ring shelf with the OC-3 interfaces on two separate and normally non-colocated OC-12 or FT-2000 OC-48 Lightwave System shelves.

Status of ACTIVE LED on Rings

In ring applications, ACTIVE LEDs on each main OLIU are always lit because it is not known if a signal on that OLIU is currently being selected by a far-end NE.

Loopbacks

The DDM-2000 OC-12 Multiplexer allows technicians to do loopbacks on all low-speed DS3 and EC-1 interfaces. Low-speed DS3 and EC-1 electronic loopbacks, directed toward the high-speed OC-12, are individually controllable from the CIT. Facility loopbacks can also be set up towards the DSX on all low-speed DS3 and EC-1 interfaces. Active electronic loopbacks are noted by the user panel's abnormal (ABN) indicator and in the alarm and status report. See the **`opr-lpbk-ds3`**, **`opr-lpbk-ec1`**, **`rls-lpbk-ds3`**, and **`rls-lpbk-ec1`** commands in Section 11, "Commands and Reports."

Front access to the OLIU optical connectors allows an easy manual OC-3 and OC-12 optical loopback. This loopback is performed by connecting a fiber jumper from the OLIU output to its input. On the 21-type OLIUs, no optical attenuator is required for this loopback. However, the optical output power switch on the 21G/21G-U OLIU circuit pack must be set for low output power to prevent receiver overload when an optical loopback is set up. On the 23G/23G-U OLIU, an external optical attenuator is required to prevent receiver overload during manual optical loopback.

Tests

Transmission Tests

Technicians can use DDM-2000 OC-12 Multiplexer internal testing capabilities for installation and manual troubleshooting. DS3 test signal generators and detectors are integrated in the system, eliminating the need for external test equipment to do DS3 transmission testing.

The DDM-2000 OC-12 Multiplexer lets technicians test specific signals and system components. For example, technicians can manually enable the integrated test signal generators and detectors for a DS3 low-speed interface. These signal tests can be run selectively in the multiplex or demultiplex direction. Refer to the **`test-trmsn-t3`** command in Section 11, "Commands and Reports."

Operations Interface Tests

The DDM-2000 OC-12 Multiplexer also provides tests for LED indicators, office alarms, and the system controller. Refer to the **`test-led`**, **`test-alm`**, and **`test-sysctl`** commands in Section 11, "Commands and Reports."

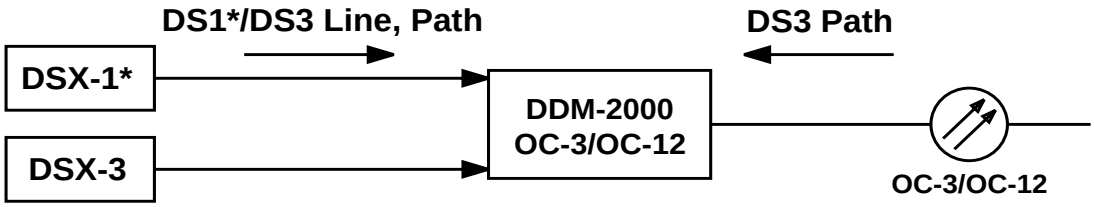
Performance Monitoring (PM)

The DDM-2000 OC-12 Multiplexer uses PM to support proactive maintenance and tariff verification of the network. Proactive maintenance refers to the process of detecting degrading conditions not severe enough to initiate protection switching or alarming but indicative of an impending hard or soft failure. Hard and soft failures result in reactive maintenance.

Proactive maintenance consists of monitoring performance parameters associated with the SONET sections, lines, and paths within the SONET network. Table 9-4 lists the SONET and DS3 performance parameters monitored by the DDM-2000 OC-12 Multiplexer. These parameters are thresholded to indicate degraded performance. When a PM threshold is crossed, it is reported to the OS connected to an TL1/X.25 link. All threshold crossings associated with a particular path can be correlated, and the likely source of the degradation can be identified.

Tariff verification refers to the process of collecting PM data on end-to-end path services (for example, DS1 and DS3). This data can be used to verify whether or not a customer is receiving the quality of service requested. Refer to Appendix A, "A SONET Overview," for more information on SONET PM.

Figure 9-9 shows DS1/DS3 line and path and DS3 path PM.



*** OC-3 Shelves Only.**

Figure 9-9. DS1/DS3 Line and Path and DS3 Path Performance Monitoring

The following are definitions and explanations for the terms used in the figure:

- Line — A line is a physical transport vehicle that provides the means of moving digital information between two points in a network. The line is characterized by a metallic transmission medium and its specific coding type. A line is bounded by its two end points, known as line terminations. A line termination is the point where the electrical, bipolar line signal is generated and transmitted, or received and decoded.
  - — DS1 (DDM-2000 OC-3 Only) — DS1 line for AMI or B8ZS coding is monitored and the errored second (ES-L) data is displayed for the incoming signal from the DSX-1.
  - — DS3 — DS3 line for B3ZS coding is monitored and the data is displayed in CV-L, ES-L, and SES-L registers for the incoming signal from the DSX-3.
- Path — A path is a framed digital stream between two points in a network and represents digital signal transport at a specified rate, independent of the equipment and media providing the physical means of transporting the signal. A path is defined by its two end points, called path terminations, where its frame structure is generated and decoded. A path may be carried wholly within one transport segment (line), or it may span a sequential arrangement of two or more transport segments.

— DS1 (DDM-2000 OC-3 Only) — DS1 near-end path is monitored for SF framing and both near-end and far-end paths are monitored for ESF framing. The data is displayed in ES-P, SES-P, and UAS-P categories. CV-P is also displayed.

— DS3 — DS3 path incoming from the fiber (high-speed side) is monitored for both P-bits and F&M bits and the data is displayed in CV-P, ES-P, SES-P, and UAS-P registers. In addition, severely errored frame seconds (SEFS) are also monitored and displayed.

DS3 path incoming from the DSX-3 (low-speed side) is also monitored, in addition to monitoring the path from the fiber, for both P-bits and F&M bits. The same registers are also displayed for the data from the DSX-3. DS3 path from both the fiber and the DSX-3 are monitored for C-Bits and are displayed in the same registers as above. The far-end data (FEBE bits) is monitored and displayed as well.

DS3 Performance Monitoring (PM)

DS3 Path PM

DDM-2000 OC-12 provides three DS3 path PM options using the BBG11B DS3 circuit pack: P-bit (parity bit), adjusted F&M bit, and C-bit. The options are selected using a command that also sets the PM mode to "on" (default) or "off", which enables or disables the monitoring and reporting of DS3 path PM data (see Table 9-4).

P-Bit

When provisioned for P-bit, the system calculates and provides counts of DS3 P-bit coding violations (CV), errored seconds (ES), severely errored seconds (SES), and unavailable seconds (UAS) incoming from the fiber and DSX. Quarter-hour and current day registers are provided with provisionable threshold crossing alerts (TCAs) on a per shelf basis. SEFS are also monitored.

Because P-bits can be corrected at nodes provisioned for violation monitor and removal (VMR) along a DS3 path, the DS3 P-bit PM data may not provide a complete report of the end-to-end DS3 path errors.

Adjusted F&M Bit

Adjusted F&M bit PM provides an alternative method for determining and accumulating DS3 path performance data based on an error estimation technique using errors on the F&M framing bits to approximate the actual error counts in the DS3 path payload. F&M bits are not corrected at nodes provisioned for VMR along a DS3 path. When provisioned for adjusted F&M bit, the system calculates

and provides estimated counts of DS3 adjusted F&M bit CV, ES, SES, and UAS incoming from the fiber and DSX. Quarter-hour and current day registers are provided with provisionable TCAs on a per-shelf basis. SEFS are also monitored.

C-Bit

When the DS3 path PM C-bit option is selected, both near-end and far-end (far-end block errors) PM data are monitored and displayed.

The system provides counts of DS3 C-bit parity CV-P, ES-P, SES-P, and UAS-P incoming from both the DSX-3 and the fiber. The type of PM is provisioned per DS3 service by a CIT command.

For C-bit PM, the DS3 service can be provisioned in VM or VMR modes. In VMR mode, the C-bit errors are not corrected as in the P-bit option.

Quarter-hour and day registers are provided with provisionable TCAs. The TCAs are provisionable on a per-shelf basis. SEFS counts are also provided.

DS3 Line Performance Monitoring

DS3 line parameters include CVL, ESL, and SESL. DS3 line PM provides provisionable bit error ratios (TCAs) for all DS3 line parameters. For CVL parameters, bit errors can also be provisioned in ratios such as 10^{-7}, 10^{-8}, and 10^{-9}.

DS3 Performance Monitoring Parameters

Table 9-4 lists the performance parameters monitored by the DDM-2000 OC-12 Multiplexer. The collection of performance parameters depends directly on slot state transitions, port states, and cross-connections.

Table 9-4. DDM-2000 OC-12 Multiplexer Performance Monitoring Parameters

Facility	Measured Parameter
OC-3 Optics	Laser Bias Current * Laser Transmit Power *
OC-12 Optics	Laser Bias Current †
OC-3 Section	Severely Errored Frame Seconds (SEFS)
OC-12 Section	Severely Errored Frame Seconds (SEFS)
EC-1 Line	B2 Coding Violations (CV) B2 Errored Seconds (ES) B2 Errored Seconds Type A (ESA) B2 Errored Seconds Type B (ESB) B2 Severely Errored Seconds (SES) B2 Unavailable Seconds (UAS)
OC-3 Line	B2 Coding Violations (CV) B2 Errored Seconds (ES) B2 Errored Seconds Type A (ESA) B2 Errored Seconds Type B (ESB) B2 Severely Errored Seconds (SES) B2 Unavailable Seconds (UAS) Line Protection Switch Counts (PSC-L)
OC-12 Line	B2 Coding Violations (CV) B2 Errored Seconds (ES) B2 Errored Seconds Type A (ESA) B2 Errored Seconds Type B (ESB) B2 Severely Errored Seconds (SES) B2 Unavailable Seconds (UAS) Line Protection Switch Counts (PSC-L)
STS-1 Path	B3 Coding Violations (CV) B3 Errored Seconds (ES) B3 Errored Seconds Type A (ESA) B3 Errored Seconds Type B (ESB) B3 Severely Errored Seconds (SES) B3 Unavailable Seconds (UAS)

See footnotes at end of table.

Table 9-4. Performance Monitoring Parameters (Cont)

Facility	Measured Parameter
DS3 Path for P-Bit, F&M Bit, and C-Bit (From Fiber and DSX)	CV-P Coding Violations Severely Errored Frame Seconds (SEFS) ES-P Errored Seconds SES-P Severely Errored Seconds UAS-P Unavailable Seconds
DS3 Line	Line Coding Violations (CVL) Errored Seconds (ESL) Severely Errored Seconds (SESL)

* 21G-U OLIU only.

† 23G/23G-U and 23H/23H-U OLIUs only.

‡ Current and previous day parameters only.

Optical Parameters

Performance Monitoring (PM) Enabling

Collection of optical parameters are initiated when a slot is equipped with an OLIU circuit pack. Parameters continue to be available in reports and generate appropriate TCAs until the OLIU is removed and the **update** command or the UPD/INIT button is pressed.

Laser Bias Current

The laser bias current is monitored continuously to detect degraded performance of the laser. A TCA is generated if the laser bias current exceeds a fixed threshold of 1.5 times the nominal value. Laser bias current is monitored independently for service and protection optical facilities. This parameter is monitored by the 21G/21G-U, 23G/23G-U, and 23H/23H-U OLIUs.

Optical Transmit Power

The optical transmit power is monitored continuously to detect degraded performance of the laser. TCAs are generated if the optical transmit power falls below fixed thresholds of –1 dB and –2 dB. Optical transmit power is monitored independently for service and protection optical facilities. This parameter is monitored only by the 21G/21G-U OLIU.

OC-3 and OC-12 Section Parameters

Performance Monitoring (PM) Enabling

Collection of section parameters are initiated when a slot is equipped with an OLIU circuit pack. Parameters continue to be available in reports and generate appropriate TCAs until the OLIU is removed and the **update** command or the UPD/INIT button is pressed.

Severely Errored Frame Seconds (SEFS)

This parameter counts the number of seconds during which an OOF, LOS, or OLIU circuit pack failure occurred. SEFSs are counted and thresholded independently for the service and the protection lines.

OC-3 and OC-12 Line Parameters

Performance Monitoring (PM) Enabling

Collection of line parameters are initiated when a slot is equipped with an OLIU circuit pack. Parameters continue to be available in reports and generate appropriate TCAs until the OLIU is removed and the **update** command or the UPD/INIT button is pressed.

Line Coding Violations (B2 Parity)

To monitor the performance of the OC-3 and OC-12 lines, the line BIP-8 (B2 parity) is calculated, written, and checked for errors. The line B2 parity violation counter is incremented for each line BIP error detected. Each line BIP-8 can detect up to eight errors per STS-1 frame. The contents of the three or 12 line B2 parity violation counters associated with the OC-3 and OC-12 line are added to form a composite B2 parity violation count. CVs are not counted during seconds that contain a line AIS, LOS, LOF, or during a UAS. The B2 parity violations are counted and thresholded independently for the service and protection lines.

Errored Seconds (ES)

An "errored second" is a second in which one or more B2 parity violations are detected. An ES "type A" is a second in which exactly one B2 parity violation is detected. An ES "type B" is a second in which more than one and less than 32 for OC-3, or more than one and less than 124 for OC-12, B2 parity violations are detected. Seconds that are UAS are not counted as ES. A second that contains a line AIS, LOS, LOF, or is a UAS is not counted as a type A or type B ES. All three of these parameters are counted and thresholded independently for the service and protection lines.

Severely Errored Seconds (SES)

A SES is a second in which 32 or more for OC-3, or 124 or more for OC-12, B2 parity violations are detected, or one in which a loss of signal, loss of frame or line AIS occurs. A UAS is not counted as a SES. SESs are counted and thresholded independently for the service and protection lines.

Unavailable Seconds (UAS)

A UAS is a second during which the OC-3 or OC-12 line is "unavailable." A line is considered "unavailable" from the beginning of X consecutive SESs until the beginning of Y consecutive seconds, none of which is severely errored. An X is equal to 10 seconds or, in the case of a failure, the line signal failure. A Y is equal

to 10 seconds of no SES or line signal failure. If there is an unprotected circuit pack failure, UAS are counted from within 1 second of circuit pack failure to within 1 second of circuit pack recovery. UAS are counted and thresholded independently for the service and protection lines.

Line Protection Switch Counts

Line protection switch count is the count of the number of protection switches FROM the working line. The count is independently counted and thresholded for both the service and the protection line. This does not apply to main OC-N lines in ring releases.

EC-1 Line Parameters

Performance Monitoring Enabling

Collection of line parameters for EC-1 low-speed interfaces is initiated when a slot is equipped with a 3STS1E circuit pack and the port is in the IS state. Parameters continue to be available in reports and generate appropriate TCAs until the input signal is removed and the **`update`** command or the UPD/INIT button is pressed. Alternatively, the EC-1 low-speed line parameters can be disabled by setting the EC-1 port state to NMON using the **`set-state-ec1`** command.

Line Coding Violations (B2 Parity)

To monitor the performance of the EC-1 line, the line BIP-8 (B2 parity) is calculated, written, and checked for errors. The line B2 parity violation counter is incremented for each line BIP error detected. Each line BIP-8 can detect up to eight errors per STS-1 frame. CVs are not counted during seconds that contain a line AIS, LOS, LOF, or during a UAS. The B2 parity violations are counted and thresholded for the EC-1 line.

Errored Seconds (ES)

An "errored second" is a second in which one or more B2 parity violations are detected. An ES "type A" is a second in which exactly one B2 parity violation is detected. An ES "type B" is a second in which more than one, and less than 12, B2 parity violations are detected. Seconds that are UAS are not counted as ES. A second that contains a line AIS, LOS, LOF, or is a UAS is not counted as a type A or type B ES. All three of these parameters are counted and thresholded for the EC-1 line.

Severely Errored Seconds (SES)

A SES is a second in which 12 or more B2 parity violations are detected or one in which a LOS, LOF, or line AIS occurs. A UAS is not counted as a SES. SES are counted and thresholded for the EC-1 line.

Unavailable Seconds (UAS)

A UAS is a second during which the EC-1 line is "unavailable." A line is considered "unavailable" from the beginning of X consecutive SES until the beginning of Y consecutive seconds, none of which is severely errored. X is equal to 10 seconds or, in the case of a failure, the line signal failure. Y is equal to 10 seconds of no SES or line signal failure. If there is an unprotected circuit pack failure, UAS are counted from within 1 second of circuit pack failure to within 1 second of circuit pack recovery. UAS are counted and thresholded for the EC-1 line.

Line Protection Switch Counts

Line protection switch counts do not apply to EC-1 interfaces.

STS-1 Path Parameters

Performance Monitoring Enabling

Collection of STS-1 path parameters is initiated only when a slot is equipped with a 3DS3 circuit pack. Parameters continue to be available in reports and generate appropriate TCAs until the 3DS3 circuit pack is removed and the **update** command or the UPD/INIT button is pressed. Path parameters are monitored only on active circuit packs.

STS-1 Path Coding Violations (B3 Parity)

The performance of the STS-1 path is monitored by writing the "B3" byte in the STS-1 path overhead when the path is originated and checking the "B3" byte for errors when the path is terminated. The B3 coding violation counter is incremented for each error detected. Up to eight errors per STS-1 frame can be detected in each STS-1 synchronous payload envelope (SPE). B3 coding violations are counted and thresholded separately for each STS-1 path terminated by the system. CVs are not counted during seconds that contain a line AIS, LOS, LOF, LOP, STS path AIS, or during a UAS. The B3 parity violations are counted and thresholded for each STS-1 path terminated by the system.

Errored Seconds (ES)

An "errored second" is a second in which one or more B3 parity violations are detected. Seconds that are UAS are not counted as ES. An ES "type A" is a second in which exactly one B3 parity violation is detected. An ES "type B" is a second in which more than one and less than nine B3 parity violations are detected. All three of these parameters are counted and thresholded independently for each STS-1 path terminated by the system.

Severely Errored Seconds (SES)

A SES is a second in which nine or more B3 parity violations are detected. SES are counted and thresholded separately for each STS-1 path terminated by the system. A UAS is not counted as a SES.

Unavailable Seconds (UAS)

An STS-1 path is considered "unavailable" from the beginning of X consecutive SES until the beginning of Y consecutive seconds, none of which is severely errored. An X is equal to 10 seconds or, in the case of a failure, the STS-1 path signal failure. A Y is equal to 10 seconds of no SES or STS path signal failure. If there is an unprotected STS-1 path terminating equipment failure (3DS3 or OLIU), UAS are counted from within 1 second of circuit pack failure to within 1 second of circuit pack recovery.

DS3 Path Parameters

Performance Monitoring (PM) Enabling

Collection of DS3 path parameters are initiated only when a slot is equipped with a 3DS3 circuit pack, the port is in the IS or NMON state, the DS3 port is provisioned for VM or VMR mode, and an STS-1 cross-connection is present (see Table 9-5). Parameters continue to be available in reports and generate appropriate TCAs until the input signal to the DS3 interface is removed and the **update** command or the UPD/INIT button is pressed (transitioning to the AUTO state). Alternatively, the DS3 path parameter can be disabled by setting the DS3 path port to the CC mode using the **set-t3** command. The PM mode parameter should be set to "on" (default), using the **set-t3** command to start PM data monitoring and reporting.

Table 9-5. DS3 Performance Monitoring Modes

	DS3 Mode		
DS3 Port State	VM	VMR	CC
IS (In Service)	Yes	Yes	No
AUTO	No	No	No
NMON (Not Monitored)	Yes	Yes	No

CV-P Coding Violations

CV-P coding violations are a count of the number of P-bit, adjusted F&M bit, or near-end and far-end C-bit parity errors in the DS3 signal received from the fiber and the DSX-3. To detect degradation of the signal, these errors are counted and thresholded independently for all DS3 interfaces provisioned in VM or VMR mode. By provisioning all NEs in the DS3 path to the VM mode, coding violations can be used as a DS3 path performance parameter when the P-bit option is selected. When the F&M-bit or C-bit option is selected, NEs could be provisioned in VMR or VM mode (see Table 9-6).

Severely Errored Frame Seconds (SEFS)

SESF are a count of the number of seconds during which an OOF or AIS condition exists for a DS3 signal received from the fiber or the DSX-3, or during an unprotected DS3 circuit pack failure. SEFSs are counted and thresholded independently for all DS3 interfaces provisioned in VM or VMR mode.

Errored Seconds (ES-P)

An "errored second" is a second in which one or more DS3 P-bit, adjusted F&M-bit, or near-end and far-end C-bit coding violations are detected. ES-P are not counted during UAS. ES are counted and thresholded independently for each DS3 path terminated by the system.

Severely Errored Seconds (SES-P)

An SES-P is a second in which 44 or more DS3 P-bit, adjusted F&M-bit, or near-end and far-end C-bit coding violations are detected. SES-P are not counted during UAS. SES are counted and thresholded independently for each DS3 path terminated by the system.

Unavailable Seconds (UAS-P)

A UAS-P is a second during which the DS3 path is "unavailable." A DS3 path is considered "unavailable" from the beginning of X consecutive SES until the beginning of Y consecutive seconds, none of which is severely errored. An X is equal to 10 seconds or, in the case of a failure, the DS3 signal failure. A Y is equal to 10 seconds of no SES or DS3 signal failures. If there is an unprotected DS3 circuit pack failure, UAS are counted from within 1 second of circuit pack failure to within 1 second of circuit pack recovery. UAS are counted and thresholded independently for each DS3 path terminated by the system. This applies to P-bit, adjusted F&M bit, and near-end and far-end C-bit options.

Table 9-6. DS3 Performance Monitoring (PM) Modes

Mode	PM Option	Monitor P-Bits	Monitor F&M Bits	Monitor C-Bits	Correct P-Bits	Correct F&M Bits	Correct C-Bits	Monitor Line PM
VMR	P-bit	Yes	No	No	Yes	No	No	Yes
VMR	F&M-bit	No	Yes	No	Yes	No	No	Yes
VMR	C-bit	No	No	Yes	Yes	No	No	Yes
VM	P-bit	Yes	No	No	No	No	No	Yes
VM	F&M-bit	No	Yes	No	No	No	No	Yes
VM	C-bit	No	No	Yes	No	No	No	Yes
CC	P-bit	No	No	No	No	No	No	Yes
CC	F&M-bit	No	No	No	No	No	No	Yes
CC	C-bit	No	No	No	No	No	No	Yes

DS3 Line Parameters

Coding Violations (CV-L)

This parameter is a count of B3ZS bipolar violations (BPV) occurring over the accumulation period. BPVs that are part of the zero substitution code are excluded.

Errored Seconds (ES-L)

This parameter is a count of seconds containing one or more BPVs, or one or more LOS (from the DSX-3) defects.

Severely Errored Seconds (SES-L)

This parameter is a count of seconds during which BPVs exceed 44, or one or more LOS defects occur.

Performance Monitoring Data Storage and Reports

The DDM-2000 OC-12 Multiplexer provides current quarter-hour and current day registers for all accumulated performance parameters. Previous quarter-hour registers for the preceding 8 hours and previous day registers also are provided.

The DDM-2000 OC-12 Multiplexer has the capability to initialize the current registers through the CIT locally or remotely at any time, as well as to report the contents of any register at any time. Refer to the **`init-pm`**, **`rtrv-pm-line`**, **`rtrv-pm-sect`**, **`rtrv-pm-sts1`**, **`rtrv-pm-t3`**, and **`rtrv-pm-tca`** commands in the "Commands and Reports" section of this manual.

Performance Monitoring During Failed Conditions

When the DDM-2000 OC-12 Multiplexer detects a trouble condition, the system stops accumulating affected performance parameters. Parameters that continue to provide useful information are accumulated during the trouble condition.

Performance Parameter Thresholds

The DDM-2000 OC-12 Multiplexer provides performance thresholds to alert maintenance staff of degraded transmission. Whenever the threshold for a

parameter is exceeded, the DDM-2000 OC-3 Multiplexer generates a TCA to alert the OS (via the TL1/X.25 interface) to the condition. A summary of all TCAs is available in the PM TCA summary report. Current quarter-hour and current day thresholds for each parameter are provisionable, via the CIT, on a per-shelf basis. Therefore, if values other than the defaults are to be used, only one value needs to be set for each parameter. Generation of TCAs can be disabled independently for each performance parameter. Performance data is still collected if thresholding is disabled. Refer to the **rtrv-pmthres-line**, **rtrv-pmthres-sect**, **rtrv-pmthres-sts1**, **rtrv-pmthres-t3, set-pmthres-line**, **set-pmthres-sect**, **set-pmthres-sts1**, **set-pmthres-t3**, and **rtrv-pm-tca** commands in Section 11, "Commands and Reports."

TCA Transmission to OS

To trigger proactive maintenance activity at the OS, the DDM-2000 OC-12 Multiplexer TL1/X.25 interface is used. Threshold crossing alerts (TCAs) are reported to the OS via **REPT EVT** messages.

Performance Monitoring Reports

TCA Summary Report

The TCA summary report lists the number of threshold crossings within the last 8 hours for quarter-hour thresholds and the number of threshold crossings for the current and previous day for daily thresholds. This snapshot provides an overall view of system performance. If there are TCAs identified, it identifies which performance status report to look at for a detailed view of those parameters. See the **rtrv-pm-tca** command in Section 11, "Commands and Reports."

Performance Status Reports

The system provides reports that contain a snapshot of all current and previous PM registers. The time registers were last reinitialized is included. The option to display a specified subset of parameters (for example, line parameters only, data for only one OC-3 line or DS3 port, etc.) is also provided. See the **rtrv-pm-sect**, **rtrv-pm-line**, **rtrv-pm-sts1**, and **rtrv-pm-t3** commands in Section 11, "Commands and Reports."

Reports

This section provides information in reports available through the CIT. For reports available through the X.25 link, refer to 824-102-151, *DDM-2000 Multiplexers Operations Systems Engineering Guide*.

Database Change Transmission to OS

All provisioning changes are automatically reported to the OS over the TL1/X.25 interface.

Alarms and Status Report

The system provides a report that lists all active alarm and status conditions. The identity of the condition (circuit pack failure, incoming OC-3 signal failure, etc.) is included in the report along with a time stamp indicating when the condition was detected. See the **rtrv-alm** command in Section 11, "Commands and Reports," for a complete list of the alarm and status conditions that are reported by the system.

Provisioning Reports

Provisioning reports list the current state of all provisionable options in the system. See the **rtrv-attr-alm**, **rtrv-attr-cont**, **rtrv-attr-env**, **rtrv-fecom**, **rtrv-lgn**, **rtrv-link**, **rtrv-ne**, **rtrv-oc3**, **rtrv-oc12**, **rtrv-pmthres-line**, **rtrv-pmthres-sect**, **rtrv-pmthres-sts1**, **rtrv-pmthres-t3**, **rtrv-passswd**, **rtrv-secu**, **rtrv-ec1**, **rtrv-sts1**, **rtrv-sts3c**, **rtrv-crs-sts1**, **rtrv-sync**, and **rtrv-t3** commands in Section 11, "Commands and Reports."

Maintenance History Report

A maintenance history report containing the past 500 alarm, status, protection switching, and CIT (for example, provisioning, loopback request, manual protection, etc.) events is provided. This summary contains real time and date stamps indicating when each condition was detected and when it cleared. CIT events contain a time stamp indicating when the command was entered. Alarm and status entries in the retrieve history report are not subject to holdoff and clear delay. See the **rtrv-hsty** command in Section 11, "Commands and Reports."

State Reports

The state reports list the states of all slots, channels, low-speed ports, and OC-3/IS-3 lines on the system. The **rtrv-state-eqpt** report includes the protection switching state ("active" or "standby") and protection switching priority of all protected lines and equipment in the system. The **rtrv-state-path** command includes protection status information for STS-1 and STS-3c paths. See the **rtrv-state-eqpt**, **rtrv-state-ec1**, **rtrv-state-oc3**, **rtrv-state-sts1**, **rtrv-state-sts3c**, and **rtrv-state-path** commands in Section 11, "Commands and Reports."

Equipment Report

This report displays the equipage and version information for one or more slots. Refer to the **rtrv-eqpt** command in Section 11, "Commands and Reports."

Neighbor Map Report

This report shows the Target Identifiers (TID) and Network Services Access Points (NSAP) of the NEs. The neighbor report lists the TIDs and NSAPs of all NEs that are immediate DCC and/or IAO LAN neighbors. Refer to the **rtrv-map-neighbors** command in Section 11, "Commands and Reports."

Network Map Report

The network report lists the TIDs and NSAPs of all reachable NEs (including level 2 ISs) in the local area only, or all reachable level 2 IS NEs in the subnetwork (if the local NE is provisioned to be a level 2 IS). Refer to the **rtrv-map-network** command in Section 11, "Commands and Reports."

Technical Specifications

10

Table of Contents

Overview 10-1

DDM-2000 OC-12 Multiplexer 10-1

- External Transmission Interfaces 10-1
- Electrical Interfaces 10-2
  - DS3 Low-Speed (BBG11/11B 3DS3) 10-2
  - EC-1 Low-Speed (BBG12 3STS1E) 10-5
- Optical Interfaces 10-6
  - Lightguide Jumpers 10-6
  - Long Reach OC-3 Interface (21G/21G-U/ 21G2-U OLIU) 10-7
  - IS-3 Interface (21D/21D-U OLIU) 10-8
  - Long Reach 1310 nm OC-12 Interface (23G/23G-U OLIU) 10-13
  - Long Reach 1550 nm OC-12 Interface (23H/23H-U OLIU) 10-13
  - OC-3 Optical Interface Mixing 10-17
  - Universal Optical Connector Attenuators 10-21
- SONET Overhead Bytes 10-22
- Performance 10-22
  - Wander/Jitter 10-22
  - Signal Performance 10-22
  - Synchronization 10-22
  - Protection Switching 10-23
  - Transient Performance 10-24
  - Delay 10-24
  - Performance Monitoring 10-24
- Operations Interfaces (OI) 10-26
  - Craft Interface Terminal (CIT) 10-26

Table of Contents

Personal Computer Specifications for Software Download 10-27
Compatible Modems 10-28
CPro-2000 Graphical User Interface and Provisioning Tool 10-29
User Panel 10-29
Equipment Indicators 10-30
Office Alarms 10-30
User-Definable Miscellaneous Discretes—Environmental Alarms and Controls 10-30
TL1/X.25 Interface 10-31
- Physical Specifications 10-33
  - OC-12 Shelf Physical Characteristics 10-33
  - Fan Shelf Physical Characteristics 10-33
  - Network Bay and Cabinet Mounting 10-33
- Environmental Specifications 10-34
  - Temperature and Humidity 10-34
  - 1550 nm Systems 10-34
  - EMC Requirements 10-34
  - Earthquake Requirements 10-34
  - Fire Resistance 10-35
  - Underwriters Laboratories 10-35
  - Canadian Standards Association 10-35
- Power Requirements 10-35
  - Shelf Fuses 10-35
  - Power Dissipation 10-36
- DDM-2000 OC-12 Reliability 10-38
  - Summary 10-38
  - Transmission Availability 10-38
  - Operation System Interface Availability 10-39
  - Optical Module Maintenance Objective 10-39
  - Infant Mortality 10-39
  - DDM-2000 OC-12 System Reliability Predictions 10-40

Technical Specifications

10

Overview

This section contains the technical specifications for the DDM-2000 OC-12 Multiplexer.

DDM-2000 OC-12 Multiplexer

External Transmission Interfaces

The DDM-2000 OC-12 Multiplexer transmission interfaces adhere to industry standards as listed in Table 10-1.

Table 10-1. Transmission Interface Standards

Interface	Standard	Comments
DS3 low-speed	*ANSI* * T1.102-1993, TR-499 Iss. 5	VMR, VM, or clear channel
EC-1	*ANSI* T1.102-1993 & TR-253, Iss. 2	
OC-3	*ANSI* T1.106/88, *ANSI* T1.105/91 TR-253, Iss. 2, TR-496, Iss. 3	
OC-12	*ANSI* T1.106/88, *ANSI* T1.105/91 TR-253, Iss. 2, TR-496, Iss. 3	

* Registered trademark of American National Standards Institute.

Electrical Interfaces

The DDM-2000 OC-12 Multiplexer supports DS3 and EC-1 electrical low-speed interfaces.

DS3 Low-Speed (BBG11/11B 3DS3)

- Electrical Specification

  The low-speed DS3 interface transmits/receives a standard electrical DS3 signal as specified in *ANSI* T1.102-1993, Section 5 (44.736 Mb/s rate, DSX-3 interconnect specification, bipolar 3-zero substitution [B3ZS] encoding). However, the signal does not have to contain a standard DS3 frame.

  Line build-out is provisionable as follows:

  — 734A/D: Up to 450 ft.

  — Mini-Coax (KS-19224, L2): 0 to 150 ft.

  — 735A: Up to 250 ft.

- Format Specification

  The DS3 low-speed interface provides clear channel (CC) transport of any DSX-3 compatible signal (M13 mode, framed CC, unframed CC). Thus, there are no format requirements on this interface.

- Alarm Thresholding

  The following parameters are monitored at the DS3 interface to the DSX-3:

  — Loss of signal (LOS)

  — Line coding violations (CV-L).

  The alarm level for each of the monitored parameters can be provisioned to CR, MJ, MN or status. B3ZS coding violation failure threshold is user settable to 10^{-3} or 10^{-6} BER.

- Performance Monitoring (PM) (see Table 10-14)

  — DS3 Parity Errors (P-bits)

  DDM-2000 OC-12 Multiplexers provide for DS3 P-bit violation monitoring and removal (VMR) based on the provisioning mode of the DS3 low-speed interface. Table 10-2 defines P-bit monitoring and correction actions in each of the DS3 modes.

  — Severely Errored Frame Seconds (SEFS)

  DDM-2000 OC-12 Multiplexers count the number of seconds during which an out-of-frame (OOF) condition exists for DS3 signals received from the fiber.

Table 10-2. DS3 Performance Monitoring (PM) Mode

	Monitor P-Bits	Correct P-Bits
VMR mode	Yes	Yes
VM mode	Yes	No
CC mode	No	No

If provisioned in the VMR or VM modes (Table 10-2), DS3 P-bit violations and SEFS are counted and the count is thresholded to flag detected performance degradation of the DS3 signal incoming from the fiber.

- Enhanced DS3 Performance Monitoring (see Table 10-14)
  - — CV-P Coding Violations

    These errors are counted and thresholded independently for all DS3 interfaces provisioned in VM or VMR mode. When the F&M bit or C-bit option is selected, network elements (NE) could be provisioned in VMR or VM mode. See Table 10-3.

Table 10-3. Enhanced DS3 Performance Monitoring Modes

Mode	PM Option	Monitor P-Bits	Monitor F&M Bits	Monitor C-Bits	Correct P-Bits	Correct F&M Bits	Correct C-Bits	Monitor Line PM
VMR	P-bit	Yes	No	No	Yes	No	No	Yes
VMR	F&M-bit	No	Yes	No	Yes	No	No	Yes
VMR	C-bit	No	No	Yes	Yes	No	No	Yes
VM	P-bit	Yes	No	No	No	No	No	Yes
VM	F&M-bit	No	Yes	No	No	No	No	Yes
VM	C-bit	No	No	Yes	No	No	No	Yes
CC	P-bit	No	No	No	No	No	No	Yes
CC	F&M-bit	No	No	No	No	No	No	Yes
CC	C-bit	No	No	No	No	No	No	Yes

  - — Errored Seconds (ES-P)

    ES-P are not counted during UAS. ES-P are counted and thresholded independently for each DS3 path terminated by the system.

— Severely Errored Seconds (SES-P)

A SES-P is a second in which 44 or more DS3 P-bit, adjusted F&M bit, or C-bit coding violations are detected. SES-P are not counted during UAS-P.
SES-P are counted and thresholded independently for each DS3 path terminated by the system.

— Unavailable Seconds (UAS-P)

An “unavailable second” is a second during which the DS3 path is unavailable. A DS3 path is considered unavailable from the beginning of X consecutive SES-P until the beginning of Y consecutive seconds, none of which is severely errored. X is equal to 10 seconds or, in the case of a failure, the DS3 signal failure. A Y is equal to 10 seconds of no SES-P or DS3 signal failures. If there is an unprotected DS3 circuit pack failure, UAS-P are counted from within 1 second of circuit pack failure to within 1 second of circuit pack recovery. UAS-P are counted and thresholded independently for each DS3 path terminated by the system. This applies to P-bit, adjusted F&M bit, and C-bit options.

— Severely Errored Frame Seconds (SEFS)

SEFS are a count of the number of seconds during which an OOF or AIS condition exists for a DS3 signal received from the fiber, or the DSX-3, or during an unprotected DS3 circuit pack failure. SEFS are counted and thresholded independently for all DS3 interfaces provisioned in VM or VMR mode.

— Line Coding Violations (CV-L)

This parameter is a count of B3ZS bipolar violations (BPV) occurring over the accumulation period. BPVs that are part of the zero substitution code are excluded.

— Errored Seconds LIne (ES-L)

This parameter is a count of seconds containing one or more BPVs, or one or more LOS (from the DSX-3) defects.

— Severely Errored Seconds LIne (SES-L)

This parameter is a count of seconds during which BPVs exceed 44, or one or more LOS defects occur.

EC-1 Low-Speed (BBG12 3STS1E)

- Electrical Specification

  The EC-1 low-speed interface transmits and receives a standard electrical EC-1 signal as specified in *ANSI* T1.102-1993 (51.844 Mb/s rate, STSX-1 interconnect specification, B3ZS encoded and scrambled).

  Line buildout is provisionable as follows:

  — 734A/D: 0 to 450 ft.

  — Mini-Coax (KS-19224, L2): 0 to 150 ft.

  — 735A: 0 to 250 ft.

- Format Specification

  The EC-1 low-speed interface provides clear channel transport of any STS-1 signal compatible with the electrical STS-1 interface specifications in *ANSI* T1.102.

- Alarm Thresholding

  The following parameters are monitored at the EC-1 interface to the STSX-1:

  — LOS

  — LOF

  — LOP

  — Line AIS

  — B2 thresholding signal fail

  — B2 thresholding signal degrade.

  The alarm level for each of the monitored parameters can be provisioned for CR, MJ, MN, or status. B2 signal degrade thresholds are user settable in the range from 10^{-6} to 10^{-9} BER.

- Performance Monitoring (see Table 10-14)

  — EC-1 line performance monitoring.

Optical Interfaces

The DDM-2000 OC-12 Multiplexer supports OC-12 long-reach applications at 1310 nm using the 23G/23G-U OLIU and at 1550 nm applications using the 23H/23H-U OLIU. The DDM-2000 OC-12 Multiplexer also supports OC-3 optical extensions using the 21G/21G-U/21G2-U and 21D/21D-U (IS-3) OLIUs. The 21G/21G-U/21G2-U OLIU is fully SONET compliant. The 21D/21D-U OLIU is a low-cost IS-3 low-speed interface used primarily to interconnect the DDM-2000 OC-3 Multiplexer to the DDM-2000 OC-12 Multiplexer at the same site. The nominal OC-3 and IS-3 line rates are 155.520 Mb/s.

Lightguide Jumpers

The DDM-2000 OC-3 and OC-12 Multiplexers provide Lucent Technologies' universal optical connector on all OLIUs. The universal optical connectors are receptacles on the faceplate of the OLIUs that allow a single OLIU to support either *ST®*, FC-PC, or SC connectors as needed. Both 0 dB and attenuating buildouts are supported.

To prevent potential degradations, the DDM-2000 OC-12 lightguide interface requires single-mode jumpers for connecting to and from the outside plant *LGX®* panel and the DDM-2000 OC-12 for all OLIUs, except the 21D/21D-U OLIU.

The 21D/21D-U OLIU, used for intershelf OC-3/OC-12 interconnection, must use multimode jumpers on the transmit and receive sides.

Lightguide jumpers can be ordered from Lucent. See the "OC-12 Ordering — Miscellaneous Equipment and Tools" section of 363-206-200 *DDM-2000 OC-3 and OC-12 Multiplexers Applications, Planning, and Ordering Guide*, for ordering information.

Long Reach OC-3 Interface (21G/21G-U/ 21G2-U OLIU)

- Optical Specification

  The 21G/21G-U/21G2-U OLIU photonics meet or exceed SONET specifications (TR 253, Iss. 2 - LR-1 MLM category). The multilongitudinal laser transmitter supplies an non return to zero (NRZ) coded signal. The PINFET receiver allows direct optical loopback without the use of an external attenuator, when the TRANSMIT POWER switch is on the low setting.

  The 21G/21G-U/21G2-U long reach OC-3 interface supports span lengths up to 55 km, assuming 0.45 dB/km single-mode fiber (including splices) and the span engineering rules outlined in Figure 10-1. Transmit and receive powers are referenced to points S and R as shown in Figure 10-1. Table 10-5 and Table 10-6 provide detailed specifications and link budget information for the 21G/21G-U/21G2-U OLIU.

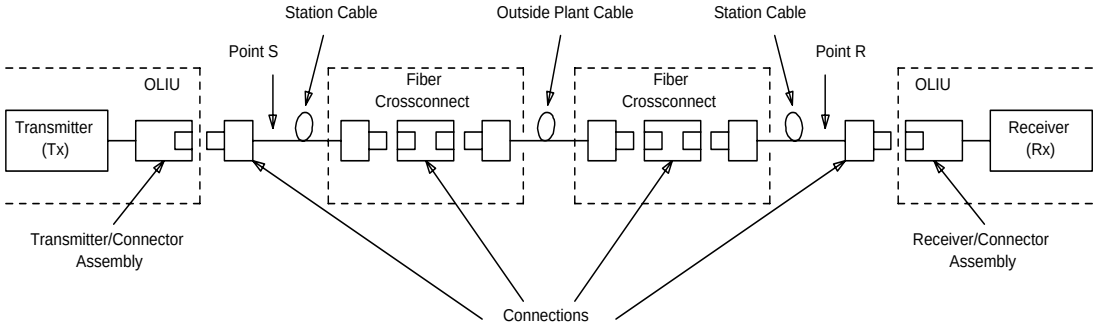


Figure 10-1. Optical System Interfaces (Points S and R)

- Alarm Thresholding

  The following parameters are monitored at the OC-3 interface.

  — LOS

  — LOF

  — LOP

- — Line AIS
- — B2 thresholding signal fail
- — B2 thresholding signal degrade.

B2 signal degrade thresholds are user settable in the range from 10^{-5} to 10^{-9} BER.

- Performance Monitoring (see Table 10-14)
  - — Section severely errored frame seconds (SEFS)
  - — Line parameter B2
  - — Laser bias current (21G/21G-U only)
  - — Transmit power (21G/21G-U only)
  - — Receive power.

IS-3 Interface (21D/21D-U OLIU)

- Optical Specification

  The 21D/21D-U OLIU is a short-reach optical interface used to interconnect between the DDM-2000 OC-3 and OC-12 Multiplexers. The nominal line rate is 155.520 Mb/s. The LED transmitter supplies an NRZ-coded signal.

  Table 10-4, Table 10-5, and Table 10-6 provide detailed specifications and link budget information for the 21D/21D-U OLIU.

- Alarm Thresholding

  The following parameters are monitored at the OC-3 interface.

  - — LOS
  - — LOF
  - — LOP
  - — Line AIS
  - — B2 thresholding signal fail
  - — B2 thresholding signal degrade.

  B2 signal degrade thresholds are user settable in the range from 10^{-5} to 10^{-9} BER.

- Performance Monitoring (seeTable 10-14)
  - — Section SEFS
  - — B2 parameters.

Table 10-4 lists the 21G/21G-U/21G2-U and 21D/21D-U OLIU specifications.

Table 10-4. 21G/21G-U/21G2-U and 21D/21D-U OLIU Specifications

System Information:		
Terminal Equipment Identification	21G/21G-U/21G2-U OLIU	21D/21D-U OLIU
Optical Line Rate (Mb/s)	155.520 Mb/s	155.520 Mb/s
Optical Line Coding	Scrambled NRZ	Scrambled NRZ
Optical Wavelength	1310 nm	1310 nm
Performance	SONET LR-1 MLM (Long Reach)	Not applicable
Transmitter Information:		
Optical Device Temperature Controller	TEC (21G/21G-U only)	No TEC
FDA Classification	Class I	Class I
Optical Source	InGaAsP Laser, MLM Structure	LED
Faceplate Optical Connector	Lucent *ST* C3000-A-2 (21G) UOC Buildout Assembly * (21G-U) Single Mode	Lucent *ST* C2000-A-2 (21D) UOC Buildout Assembly * (21D-U) Multimode
Receiver Information:		
Optical Device Temperature Controller	None	None
Optical Detector	InGaAsP PIN	InGaAsP PIN
Faceplate Optical Connector	*ST* C2000-A-2 (21G) UOC Buildout Assembly * (21G-U) Multimode	Lucent *ST* C2000-A-2 (21D) UOC Buildout Assembly * (21D-U) Multimode

***** The universal optical connector (UOC) buildout assembly consists of a faceplate-mounted block assembly and either 0 dB, 5 dB, 10 dB, or 15 dB buildout in either *ST*®, SC, or *FC*-type connectors.

Table 10-5. 21G/21G-U and 21D/21D-U OLIU Link Budgets (Note 1)

Parameter	21G2-U (Note 3)	21G/21G-U (Note 2) Tx High	21G/21G-U (Note 2) Tx Low	21D/21D-U/ 22D-U
Minimum Wavelength (l_{Tmin})	1280 nm	1280 nm	1280 nm	1270/1260* nm
Maximum Wavelength (λ_{Tmax})	1335 nm	1335 nm	1335 nm	1380 nm
Spectral Width ($\delta\lambda_{rms}$)	4.0 nm	4.0 nm	4.0 nm	170 nm ¶¶
Maximum Transmitter Power (P_{Tmax})	0.0 dBm	-2.5 dBm	-7.5 dBm	-14.0 dBm
Minimum Transmitter Power (P_{Tmin})	-5.0 dBm	-5.0 dBm	-11.4 dBm	-18.8/-21.8* dBm
Maximum Received Power (P_{Rmax})	0.0 dBm	-7.0 dBm	-7.0 dBm	-14.0 dBm
Minimum Received Power (P_{Rmin})	-34.0 dBm	-34.0 dBm	-34.0 dBm	-33.8/-31.8* dBm
Minimum System Gain (S-R)‡	29.0 dB	29.0 dB	22.6 dB	15/10.0* dB
Optical Path Penalty (P_O)§	1.0 dB	1.0 dB	1.0 dB	1.6 dB
Connector Loss¶	1.5 dB	1.5 dB	1.5 dB	1.5 dB
Unallocated Margin**	1.5 dB	1.5 dB	1.5 dB	2.0 dB
Minimum Loss Budget	0.0 dBm	4.5 dB††	0.0 dB	0.0 dB
Maximum Loss Budget‡‡	**25.0 dB**	**25.0 dB**	**18.6 dB**	**9.9/4.9* dB**
Maximum Span Length§§	55 km	55 km	41 km	(Note 4)

Notes:

1. All terminology is consistent with TR-253, Iss. 2. All specifications for 21G/21G-U/21G2-U OLIU meets or exceeds long reach (LR) values described in TR-253, Iss. 2.
2. The High/Low transmitted power switch on the 21G/21G-U OLIU circuit pack allows for loopbacks or small outside plant (OSP) budgets without external attenuators.
3. The 21G2-U does not have a High/Low transmitter power switch. When transmitting from a 21G2-U to a 21G-U, 22F-U, 22D-U or 22G-U OLIU an external attenuator may be required. An attenuator is not required when transmitting to 22F2-U or 22G2-U OLIUs.
4. Multimode only (see Table 10-6).

* When two numbers are given, the number before the slash is the specification for operating under controlled environmental conditions. The number following the slash is the specification for uncontrolled environmental conditions. If only one number is given, it applies to both controlled and uncontrolled environmental conditions.

† Transmit and receive powers are referenced to points S and R as shown in Figure 10-1.

‡ The minimum system gain for the DDM-2000 already takes into account aging, temperature, and manufacturing tolerances as these figures are built into the minimum transmitter power. The DDM-2000 system gain can, thus, not be directly compared with the DDM-1000 system gain because the DDM-1000 system gain does not include all of these effects. A similar penalty, called eye margin, is subtracted from the DDM-1000 loss budget after the value of system gain is determined.

§ Optical path penalty includes effects of dispersion, reflection and jitter that occur on the optical path.

¶ One connector (0.75 dB) on each end is assumed to connect station cable to outside plant.

** Unallocated margin, or safety margin, is typically specified from 0 dB to 3 dB.

†† If the loss budget is less than 6.0 dB, use low power. Includes a 1.5 dB safety margin.

‡‡ Budget available for both station and transmission cable and splices.

§§ Attenuation and dispersion can be the limiting factors in span length. For OC-3 single-mode fiber systems, dispersion is not a factor and all applications are attenuation limited. For OC-12 systems, the maximum distance could be either attenuation limited or dispersion limited. The limits must be calculated based on both factors and the lesser of the two defines the actual maximum span length. A rough rule of thumb for attenuation-limited systems is 0.45 dB/km. This estimate includes typical cable loss (0.4 dB/km) and splice loss (0.2 dB per splice, 11 total splices) associated with single-mode fiber.

Maximum span length can be calculated more precisely based on particular fiber and splice characteristics and local engineering rules.

¶¶ Full width at half maximum (FWHM) spectral width.

Table 10-6. OC-3 OLIUs Link Budget — Multimode Operation

Fiber Bandwidth	Maximum Span Length (km)	
	21G/21G-U/21G2-U (Note 1)	21D/21D-U (Note 2)
1000 MHz-km	6.5	3.6/3.4
800 MHz-km	5.1	3.4/3.3
500 MHz-km	3.1	2.7
300 MHz-km	1.8	1.9

Notes:

1. Maximum 21G/21G-U/21G2-U MM Link Budget (dB) for multimode operation is 22.0 dB for high power and 15.6 dB for low power.
2. When two numbers are given, the number before the slash is the specification for operating under controlled environmental conditions. The number following the slash is the specification for uncontrolled environmental conditions. If only one number is given, it applies to both controlled and uncontrolled environmental conditions.

Multimode fiber operation on the DDM-2000 OC-3 Multiplexer requires a minimum exit bandwidth of 120 MHz to ensure that dispersion loss is kept below acceptable levels. If the fiber is already installed and the exit bandwidth is measured to be 120 MHz or greater, then the maximum link budget values (22 dB, 15.6 dB, and 12 dB, respectively) can be used to determine if the loss budget is sufficient for that fiber.

The system is dispersion limited for all the fiber bandwidths listed in this table.

If planning a new fiber installation, the values at the end of the table, given for a number of commercially available fiber bandwidth-distance products, can be used. Fiber distances are calculated using the 120 MHz exit bandwidth limit, however, actual exit bandwidths may be higher for these distances due to the existence of splices. This may permit longer span lengths to be achieved, for the given fiber bandwidths, than those specified in the table. In this case, however, the span length can only be increased to the point where the system is loss-limited as specified by the maximum multimode link budget given in the table (1 dB/km cable is assumed).

Long Reach 1310 nm OC-12 Interface (23G/23G-U OLIU)

The DDM-2000 OC-12 Multiplexer supports a 1310 nm OC-12 high-speed interface that is fully SONET-compliant. The nominal OC-12 line rate is 622.08 Mb/s.

- Optical Specification

  The OLIU photonics meet or exceed SONET long reach specifications (TR-LR-1 MLM category). The multilongitudinal mode laser transmitter supplies an NRZ-coded signal. The receiver requires the use of an external attenuator for direct optical loopback.

  The 23G/23G-U OLIU long reach OC-12 interface supports span lengths up to 51 km, assuming 0.45 dB/km single-mode fiber (including splices) and the span engineering rules outlined in Table 10-8. Transmit and receive powers are referenced to points S and R as shown in Figure 10-1.

- Laser bias current is monitored on the 23G/23G-U OLIU.

Long Reach 1550 nm OC-12 Interface (23H/23H-U OLIU)

The DDM-2000 OC-12 Multiplexer supports a 1550 nm OC-12 long reach high-speed interface for controlled environments. The nominal OC-12 line rate is 622.08 Mb/s.

- Optical Specification

  The single longitudinal mode laser transmitter supplies an NRZ-coded signal. The receiver requires the use of an external attenuator for direct optical loopback.

  The 23H/23H-U OLIU long reach OC-12 interface supports span lengths up to 100 km, assuming single-mode fiber with total dispersion of less than 1800 ps/nm and the span engineering rules outlined in Table 10-8. Transmit and receive powers are referenced to points S and R as shown in Figure 10-1.

Table 10-7 lists the 23G/23G-U and 23H/23H-U OLIU specifications.

Table 10-7. 23G/23G-U and 23H/23H-U OLIU Specifications

System Information:		
Terminal Equipment Identification	23G/23G-U OLIU	23H/23H-U OLIU
Optical Line Rate (Mb/s)	622.080 Mb/s	622.08 Mb/s
Optical Line Coding	Scrambled NRZ	Scrambled NRZ
Optical Wavelength	1310 nm	1550 nm
Performance	SONET LR-1 MLM (Long Reach)	Not Applicable
Transmitter Information:		
Optical Device Temperature Controller	TEC	TEC
FDA Classification	Class I	Class I
Optical Source	InGaAsP Laser, MLM Structure	InGaAs Laser SLM Structure
Faceplate Optical Connector	Lucent Buildout Assembly* (23G) UOC Buildout Assembly † (23G-U) Single Mode	Lucent Buildout Assembly (23H)* UOC Buildout Assembly † (23H-U) Single Mode
Receiver Information:		
Optical Device Temperature Controller	None	None
Optical Detector	Ge APD/InGaAs PIN	InGaAs APD
Faceplate Optical Connector	*ST* C2000-A-2 (23G) UOC Buildout Assembly † (23G-U) Multimode	Lucent *ST* C2000-A-2 (23H) UOC Buildout Assembly † (23H-U) Multimode

* Buildout assembly consists of A3001 *ST*® lightguide buildout block assembly and one of the following: A3010 (0 dB), A3010B (5 dB), A3010D (10 dB), and A30310F (15 dB). For 23H loopback testing requiring 19 dB, use the 4C Test Cable.

† The universal optical connector (UOC) buildout assembly consists of a faceplate-mounted block assembly and either 0 dB, 5 dB, 10 dB, or 15 dB buildout in either *ST*, SC, or *FC*-type connectors. For 23H-U loopback testing requiring 10 dB, use A3060D1 SC, A3070D1 *ST*, or A3080D1 *FC* attenuators as applicable.

Table 10-8. 23G/23G-U and 23H/23H-U OLIU Link Budgets (Note 1)

Parameter	23G/23G-U (Note 2)	23H/23H-U (Note 3)
Minimum Wavelength (λ_{Tmin})	1298 nm	1530 nm
Maximum Wavelength (λ_{Tmax})	1325 nm	1570 nm
Spectral Width* ($\delta\lambda_{rms}$)	2.0 nm	<1.0 nm
Maximum Transmitter Power† (P_{Tmax})	+2.0 dBm	+2.0dBm
Minimum Transmitter Power (P_{Tmin})	–2.5/–3.0 dBm‡	–2.8 dBm
Maximum Received Power (P_{Rmax})	–8.0 dBm	–17.0 (23H) –8.0 (23H-U) dBm
Minimum Received Power (P_{Rmin})	–30.5/–27.5 dBm‡	–34.0 dBm
Minimum System Gain (S-R)§	28.0/24.5 dBm‡	31.2 dBm
Optical Path Penalty (P_O)¶	2.0 dB	1.0 dB
Connector Loss**	1.5 dB	1.5 dB
Unallocated Margin††	1.5 dB	1.5 dB
Minimum Loss Budget‡‡	10.0 dB	19.0 (23H) 10.0 (23H-U) dB
Maximum Loss Budget§§	23.0/19.5 dB‡	27.2 dB‡
Maximum Span Length¶¶	51/43 km	100 km

Notes:.

1. All terminology is consistent with TR-253, Iss. 2. All values are worst-case end of life.
2. All specifications for the 23G/23G-U meet or exceed long reach (LR) values described in TR-253, Iss. 2.
3. This loss budget applies to 1550 nm optical signals transmitted and received by the 23H/23H-U.

* RMS spectral width for the 23G/23G-U. Maximum –20 dB down spectral width for the 23H/23H-U.

† Transmit and receive powers are referenced to points S and R as shown in Figure 10-1.

‡ When two numbers are given, the number before the slash is the specification for operating under controlled environmental conditions. The number following the slash is the specification for uncontrolled environmental conditions. If only one number is given, it applies to both controlled and uncontrolled environmental conditions (23G/23G-U only). The 23H/23H-U operates under controlled environmental conditions only.

§ The minimum system gain for the DDM-2000 already takes into account aging, temperature, and manufacturing tolerances as these figures are built into the minimum transmitter power. The DDM-2000 system gain can, thus, not be directly compared with the DDM-1000 system gain because the DDM-1000 system gain does not include all of these effects. A similar penalty, called eye margin, is subtracted from the DDM-1000 loss budget after the value of system gain is determined.

¶ Optical path penalty includes effects of dispersion, reflection and jitter that occur on the optical path. The 23G/23G-U has 5.0 dB of total margin. Optical path penalty is normally 1.0 dB. This allows for a maximum dispersion of 92 psec/nm in the 1310 nm wavelength range. To allow for span lengths greater than 40 km, 2.0 dB is allocated for optical path penalty. This allows a maximum dispersion of 120 ps/nm. 1.0 dB is allocated for the optical path penalty for the 23H/23H-U for operation in the 1550 nm wavelength range. This allows a maximum dispersion of 1800 ps/nm.

** One connector (0.75 dB) on each end is assumed to connect station cable to outside plant.

†† Unallocated margin, or safety margin, is typically specified from 0 dB to 3 dB.

‡‡ The 23G/23G-U requires an external lightguide buildout as part of the connector assembly for loopbacks and for loss budgets less than 10 dB. The 23H/23H-U requires an external lightguide buildout as part of the connector assembly for loopbacks and for loss budgets less than 19 (23H) or 10 (23H-U) dB.

§§ Budget available for both station and transmission cable and splices.

¶¶ Attenuation and dispersion can be the limiting factors in span length. For OC-12 systems, the maximum distance could be either attenuation limited or dispersion limited. The limits must be calculated based on both factors and the lesser of the two defines the actual maximum span length. A rough rule of thumb for attenuation-limited systems operating in the 1310 nm wavelength range is 0.45 dB/km. This estimate includes typical cable loss (0.4 dB/km) and splice loss (0.2 dB per splice, 11 total splices) associated with single-mode fiber in the 1310 nm range. A rough rule of thumb for systems operating in the 1550 nm wavelength range on modern nondispersion shifted fiber is 0.25 dB/Km.

Allowing 2.0 dB for the optical path penalty implies 120 ps/nm total dispersion in the 1310 nm wavelength range. Typical maximum slope for single-mode fiber in this wavelength is 0.092 ps/nm squared per km. Typical nondispersion shifted fiber has a zero dispersion wavelength between 1300 and 1320 nm. Given these assumptions, the maximum span length for the 23G/23G-U is 51km.

For OC-12 systems operating in the 1550 nm wavelength range, the maximum distance is dispersion limited. Allowing 1 dB for the optical path penalty implies 1800 ps/nm total dispersion. Typical modern nondispersion shifted fiber has 18 ps/(nm•km) dispersion in the 1550 nm wavelength range. Given these assumptions, the maximum span length for the 23H/23H-U is 100 km.

Maximum span length can be calculated more precisely based on particular fiber and splice characteristics and local engineering rules.

OC-3 Optical Interface Mixing

Mixing different OC-3 rate OLIUs at opposite ends of an optical link is often necessary for technical reasons or for convenience. The following information will aid in planning and engineering optical links having different types of OC-3 rate OLIUs at each end of the fiber. Table 10-9 details the minimum link budget necessary for each pairing of OC-3 rate OLIUs.

To use Table 10-9, locate the number at the intersection of the transmitter/receiver pair of interest. This number is the minimum attenuation necessary for proper operation of that transmitter/receiver pair. The link must have at least this much attenuation either from fiber loss, splice loss, connector loss, external attenuators, or a combination of these, or the receiver will be overdriven and the link will not operate properly.

Table 10-9. OC-3 Rate OLIU Mixes - Minimum Link Budgets (dB)

	Receiver						
Transmitter	21G/21G-U	21G2-U	22F/ 22F-U	22G-U*	22G2-U	21D/21D-U/ 22D-U	22F2-U
21G/21G-U (high power)	4.5	0.0	4.5	4.5	0.0	11.5	0.0
21G/21G-U (low power)	0.0	0.0	0.0	0.0	0.0	6.5	0.0
21G2-U	7.0	0.0	7.0	7.0	0.0	14.0	0.0
22F/22F-U/ 22F2-U	0.0	0.0	0.0	0.0	0.0	6.0	0.0
22G-U*	7.0	0.0	7.0	7.0	0.0	14.0	0.0
22G2-U	7.0	0.0	7.0	7.0	0.0	14.0	0.0
21D/21D-U/ 22D-U	0.0	0.0	0.0	0.0	0.0	0.0	0.0

***** The LAA10 FT-2000 OC-3 Optical Interface has the same optical loss budget as the 22G-U and therefore should follow the same optical mixing rules.

Note that the minimum link budget is not always symmetrical. A transmitter/ receiver pair may have one minimum link budget in one direction and another in the opposite direction. For example, a 21G/21G-U (low power) OLIU transmitting to a 21D/21D-U (controlled environment) OLIU has a minimum link budget of 6.5 dB. In the opposite direction, though, a 21D/21D-U (controlled environment) OLIU transmitting to a 21G/21G-U (low power) OLIU has a minimum link budget of 0.0 dB. Be careful of this asymmetry when planning and engineering a link having mixed OLIUs.

NOTE:
When using universal optical buildout attenuators for OLIUs equipped with Universal Optical Connectors (for example, 22G-U and 22D-U), the buildout must have the same type fiber on both sides, that is, single-mode to single-mode or multimode to multimode. The buildout must also match the mode of the fiber. Therefore, when a single-mode jumper is used, the buildout would be on the transmit side (OUT) of the OLIU and when a multimode jumper is used, the buildout would be on the receive side (IN) of the OLIU. When using in-line attenuators for non-U OLIUs, place the attenuator in the bay frame PANDUIT. Make sure that the mode type of the attenuator matches the mode of the fiber to ensure proper attenuation.

Table 10-10 details the maximum link budgets for each pairing of OC-3 rate OLIUs when operating on single-mode (SM) fiber. These numbers give the maximum attenuation acceptable for proper operation of each transmitter/receiver pair. The link must have no more than this much attenuation either from fiber loss, splice loss, connector loss, external attenuators or a combination of these or the link will not operate properly. The maximum link budgets for SM fiber were calculated using the following margins:

- Optical Path Penalty (dB) 1.0
- Connector Loss (dB) 1.5

Table 10-10. OC-3 Rate OLIU Mixes — Maximum Link Budgets for SM Fiber (dB)

Transmitter	Receiver					
	21G/ 21G-U	21G2-U	22F	22G-U*/ 22G2-U	21D/21D-U/ 22D-U (Ctrld. Env.)	21D/21D-U/ 22D-U (Unctrld. Env.)
21G/21G-U (high power)	25.0	25.0	25.0	25.0	24.8	22.8
21G/21G-U (low power)	18.6	18.6	18.6	18.6	18.4	16.4
21G2-U	25.0	25.0	25.0	25.0	24.8	22.8
22F	15.0	15.0	15.0	15.0	14.8	12.8
22G-U*/22G2-U	23.0	23.0	23.0	23.0	22.8	20.8
21D/21D-U/22D-U (ctrld. env.)	n/a	n/a	n/a	n/a	n/a	n/a
21D/21D-U/22D-U (unctrld. env.)	n/a	n/a	n/a	n/a	n/a	n/a

***** The LAA10 FT-2000 OC-3 Optical Interface has the same optical loss budget as the 22G-U and therefore should follow the same optical mixing rules.

NOTE:
The maximum link budget is not always symmetrical. A transmitter/receiver pair may have one maximum link budget in one direction and another in the opposite direction. For example, a 21G/21G-U (low power) OLIU transmitting to a 22F OLIU has a maximum SM link budget of 18.6 dB. In the opposite direction, though, a 22F OLIU transmitting to a 21G/21G-U (low power) OLIU has a maximum SM link budget of 15.0 dB. Be careful of this asymmetry when planning and engineering a link having mixed OLIUs. Note also that 21D/21D-U and 22D-U OLIUs will not operate when transmitting into single-mode fiber.

Table 10-11 details the maximum link budgets for each pairing of OC-3 rate OLIUs when operating on multimode (MM) fiber. These numbers give the maximum attenuation acceptable for proper operation of each transmitter/receiver pair. The link must have no more than this much attenuation either from fiber loss, splice loss, connector loss, external attenuators or a combination of these or the link will not operate properly. The maximum link budgets for MM fiber were calculated using the following margins. The first column of margins applies to any link where there is at least one OC-3 OLIU (21G/21G-U, 22F or 22G-U/22G2-U). The second column of margins applies to links having two IS-3 (21D/21D-U or 22D-U) OLIUs.

	At Least One OC-3 OLIU	IS-3 OLIUs Only
MM Optical Path Penalty (dB)	4.0	1.6
Connector Loss (dB)	1.5	1.5
Unallocated Margin (dB)	1.5	2.0

NOTE:
The maximum link budget is not always symmetrical. A transmitter/receiver pair may have one maximum link budget in one direction and another in the opposite direction. For example, a 21G/21G-U (low power) transmitting to a 22F has a maximum MM link budget of 15.6 dB. In the opposite direction, though, a 22F transmitting to a 21G/21G-U (low power) has a maximum SM link budget of 12.0 dB. Be careful of this asymmetry when planning and engineering a link having mixed OLIUs.

Table 10-11. OC-3 Rate OLIU Mixes—Maximum Link Budgets for MM Fiber (dB)

	Receiver					
Transmitter	21G/ 21G-U	21G2-U	22F	22G-U*/ 22G2-U	21D/21D-U/ 22D-U (Ctrld. Env.)	21D/21D-U/ 22D-U (Unctrld. Env.)
21G/21G-U (high power)	22.0	22.0	22.0	22.0	21.8	19.8
21G/21G-U (low power)	15.6	15.6	15.6	15.6	15.4	13.4
21G2-U	22.0	22.0	22.0	22.0	21.8	19.8
22F	12.0	12.0	12.0	12.0	11.8	9.8
22G-U*/22G2-U	20.0	20.0	20.0	20.0	19.8	17.8
21D/21D-U/22D-U (ctrld. env.)	8.2	8.2	8.2	8.2	9.9	7.9
21D/21D-U/22D-U (unctrld. env.)	5.2	5.2	5.2	5.2	6.9	4.9

* The LAA10 FT-2000 OC-3 Optical Interface has the same optical loss budget as the 22G-U and, therefore, should follow the same optical mixing rules.

Universal Optical Connector Attenuators

The DDM-2000 OC-3 and OC-12 Multiplexers provide Lucent's universal optical connector on all OLIUs. This connector is a two-part connector consisting of a faceplate-mounted block and an optical buildout. The faceplate block optionally supports an *ST*, SC, or FC-type optical buildout.

A 0 dB *ST*-type connector is shipped as standard with each OLIU. Optional SC, or FC 0 dB, or attenuated buildouts can be ordered separately as listed in Table 10-12. Table 10-12 lists single-mode (SM) and multimode (MM) attenuated buildouts.

Table 10-12. Universal Buildout Attenuators

Description	Connection	Loss (dB)	Comcode
A3010A *ST*® 0 dB buildout *	SM-SM	0	106312523
A3010B *ST* 5 dB buildout *	SM-SM	5	106312556
A3010C *ST* 10 dB buildout *	SM-SM	10	106312572
A3010D *ST* 15 dB buildout *	SM-SM	15	106312598
A3010E *ST* 20 dB buildout *	SM-SM	20	106312630
A3060 SC 0 dB buildout	SM-SM & MM-MM	0	106708951
A3060B1 SC 5 dB buildout	SM-SM	5	107406142
A3060D1 SC 10 dB buildout	SM-SM	10	107406159
A3060F1 SC 15 dB buildout	SM-SM	15	107406167
A3070 *ST*® 0 dB buildout	SM-SM & MM-MM	0	106795354
A3070B1 *ST* 5 dB buildout	SM-SM	5	107406183
A3070D1 *ST* 10 dB buildout	SM-SM	10	107406191
A3070F1 *ST* 15 dB buildout	SM-SM	15	107406209
A3080 FC 0 dB buildout	SM-SM & MM-MM	0	106795404
A3080B1 FC 5 dB buildout	SM-SM	5	107406225
A3080D1 FC 10 dB buildout	SM-SM	10	107406233
A3080F1 FC 15 dB buildout	SM-SM	15	107406241
A2060B SC 5 dB buildout	MM-MM	5	106795271
A2060D SC 10 dB buildout	MM-MM	10	106795289
A2060F SC 15 dB buildout	MM-MM	15	106795297
A2070B *ST* 5 dB buildout	MM-MM	5	106795313
A2070D *ST* 10 dB buildout	MM-MM	10	106795321
A2070F *ST* 15 dB buildout	MM-MM	15	106795339

* 23G and 23H only.

SONET Overhead Bytes

The only use of SONET overhead bytes for proprietary signaling is the K2 byte for synchronization messaging. See Section 6, "System Planning and Engineering," of 363-206-200 *DDM-2000 OC-3 and OC-12 Multiplexers Applications, Planning, and Ordering Guide,* for more information on synchronization messaging.

Performance

Wander/Jitter

- For SONET optical interfaces, the maximum time interval error (MTIE) does not exceed 60 nanoseconds phase variation when timed with a wander-free reference.
- Jitter transfer, tolerance, and generation requirements are met as specified in TR-253 and TR-499.
- The SONET interface meets the T1.101 OC-N output short term stability mask.

Signal Performance

- For systems interfacing at the DS3 rate, the number of errored seconds, during a 2-hour, one-way loopback test, is less than 72.
- The BER is less than 10^{-9} for DS3 rates. Burst error seconds are excluded.
- The frequency of burst errored seconds, other than those caused by protection switching induced by hard equipment failures, average less than four per day.

Synchronization

Synchronous Timing Generator (BBF2/BBF2B)

The TGS circuit pack meets the specifications of GR-253-CORE, SONET Transport Systems Generic Criteria. The TGS circuit pack supports three timing modes:

- External timing (phase-locked mode): Locked to external Stratum 3 (±4.6 ppm) or better DS1 reference.
- Line-timing: Locked to recovered clock from an OC-N signal.
- Free-running: Timing derived from high-stability temperature-compensated voltage-controlled crystal oscillator (TCVCXO) with a long-term accuracy of ±15 ppm (–40°C to +75°C).

Holdover mode is entered on failure of external timing or line-timing reference, providing a temperature stability of ±8.8 ppm (–40°C to +75°C). 24-hour holdover stability will be better than ±4.6 ppm.

The DS1 timing output used for network synchronization (BBF2B only) provides long-term accuracy traceable to the OC-12 line. SONET synchronization messaging is used to output DS1 AIS when clock traceability is lost. Jitter on the DS1 output is less than 0.06 unit interval peak-to-peak.

Synchronous Timing Generator 3 (BBF4)*

The TG3 Stratum 3 circuit pack meets the specifications of GR-253-CORE, SONET Transport Systems Generic Criteria. The TG3 circuit pack supports three timing modes:

- External timing: Locked to external Stratum 3 (±4.6 ppm) or better DS1 reference.
- Line-timing: Locked to recovered clock from an OC-N signal.
- Free-running: Timing derived from high-stability temperature-compensated voltage-controlled crystal oscillator (TCVCXO) with a long-term accuracy of ±4.6 ppm and temperature stability of ±2 ppm.

Holdover mode is entered on failure of external timing or line-timing reference, providing a temperature stability of ±2 ppm (–40°C to +75°C) or ± .3 ppm (0°C to +70°C). Holdover capability for 24 hours will be better than ±.37 ppm.

The DS1 timing output used for network synchronization (BBF2B or BBF4) provides long-term accuracy traceable to the OC-N signal.

Protection Switching

Ring Networks

Path protection rings feed a SONET payload (STS or virtual tributary [VT]) from the ring entry point, simultaneously in both rotations of the ring, to the signal's ring exit point. The node that terminates the signal from the ring monitors both ring rotations and is responsible for selecting the signal that has the highest quality based on LOS, path AIS, and path BER performance. On pass-through paths, all detected hard failures (LOS, LOF, LOP, line AIS, STS path AIS, or STS unequipped) result in STS AIS insertion in the outgoing signals. This allows the terminating node to be aware of the failure and to switch to protection. Protection switching is completed within 50 milliseconds of failure detection.

Under normal conditions, both incoming SONET path signals to the switch selection point are of high quality, and the signal can be selected from either ring. A failure or a transmission degradation on one of the rings requires that the other ring path be selected. Nonrevertive switching minimizes the impact on critical customer services by giving the service provider control when, and if, the critical service should revert to a particular ring. A manual path protection switching command allows switching back to the original path for ease of ring maintenance.

* Available third quarter 1997 for use with Release 7.0 and later.

The protection switching interrupt interval in response to an equipment failure is 60 milliseconds for all 1x1 protected circuit packs. The interrupt interval is measured at the DSn interface.

Transient Performance

Power Loss Restart

After system shutdown due to power loss, the system will exhibit a 2-second error free transmission interval which begins within 1 minute of restoration of power.

Transmission Start-Up on Signal Application

The system, after having no signal applied for greater than 1 minute at the DSX-n interface or at any nonhierarchical interface, will exhibit a 2-second error free transmission interval which begins within 5 seconds of the reapplication of a signal.

Delay

Table 10-13 lists the worst-case measured one-way delay within a DDM-2000 OC-12 Multiplexer and OC-12 Regenerator.

Table 10-13. OC-12 Multiplexer and OC-12 Regenerator Transmission Delay in Microseconds

	Drop Interface			
Mode	OC-12	OC-3/OC-3c	DS3	EC-1
Terminal		4	5	4
Ring	4	4	5	4
OC-12 Regenerator	2			

Performance Monitoring

Table 10-14 shows the provisionable range of the thresholds for monitored parameters and, in parentheses, the default thresholds. Thresholding of any parameter(s) can be disabled. PM parameters are provisionable via the CIT.

Table 10-14. Performance Monitoring Parameters Provisionable via the CIT

Parameter Definition		Threshold Range (Default)		Command
Facility	Measure	Current Quarter Hour	Current Day	set-pmthres-
OC-12 Optics	Laser Bias Current *	enable/disable	enable/disable	**sect**
OC-3 Optics	Optical Transmit Power *(21G/21G-U only) Laser Bias Current* (21G/21G-U only)	-1 dB, -2 dB enable/disable	-1 dB, -2 dB enable/disable	**sect** **sect**
OC-12 Section	SEFS	1-63 [10]	1-4095 [30]	**sect**
OC-3 Section	SEFS	1-63 [10]	1-4095 [30]	**sect**
OC-12 Line	B2 Coding Violations (CV) B2 Errored Seconds (ES) B2 Errored Seconds Type A (ESA) B2 Errored Seconds Type B (ESB) B2 Severely Errored Seconds (SES) B2 Unavailable Seconds (UAS) Line Protection Switch Counts (PSC-L)	1-55365 [5537] 1-900 [40] 1-900 [30] 1-900 [30] 1-63 [20] 1-63 [30] 1-63 [2]	1-5315040 [531504] 1-65535 [900] 1-65535 [90] 1-65535 [90] 1-4095 [60] 1-4095 [90] 1-255 [4]	**line** **line** **line** **line** **line** **line** **line**
OC-3 Line	B2 Coding Violations (CV) B2 Errored Seconds (ES) B2 Errored Seconds Type A (ESA) B2 Errored Seconds Type B (ESB) B2 Severely Errored Seconds (SES) B2 Unavailable Seconds (UAS) Line Protection Switch Counts (PSC-L)	1-13841 [1384] 1-900 [40] 1-900 [30] 1-900 [30] 1-63 [20] 1-63 [30] 1-63 [2]	1-1328736 [132874] 1-65535 [900] 1-65535 [90] 1-65535 [90] 1-4095 [60] 1-4095 [90] 1-255 [4]	**line** **line** **line** **line** **line** **line** **line**
EC-1 Line	B2 Coding Violations (CV) EC-1 B2 Errored Seconds (ES) B2 Errored Seconds Type A (ESA) B2 Errored Seconds Type B (ESB) B2 Severely Errored Seconds (SES) B2 Unavailable Seconds (UAS)	1-4613 [461] 1-900 [40] 1-900 [30] 1-900 [30] 1-63 [20] 1-63 [30]	1-442848 [44285] 1-65535 [900] 1-65535 [90] 1-65535 [90] 1-4095 [60] 1-4095 [90]	**line** **line** **line** **line** **line** **line**
STS-1 Path	B3 Coding Violations (CV) B3 Errored Seconds (ES) B3 Errored Seconds Type A (ESA) B3 Errored Seconds Type B (ESB) B3 Severely Errored Seconds (SES) B3 Unavailable Seconds (UAS)	1-4510 [451] 1-900 [40] 1-900 [30] 1-900 [30] 1-63 [20] 1-63 [30]	1-432960 [43296] 1-65535 [900] 1-65535 [90] 1-65535 [90] 1-4095 [60] 1-4095 [90]	**sts1** **sts1** **sts1** **sts1** **sts1** **sts1**
Enhanced DS3 Path for P-Bits, F&M Bits, and C-Bits from Fiber and DSX	CV-P Coding Violations ES-P Errored Seconds SES-P Severely Errored Seconds UAS-P Unavailable Seconds SEFS	1-16383 [40] 1-900 [25] 1-63 [4] 1-63 [10] 1-63 [2]	1-1048575 [3820] 1-65535 [250] 1-4095 [40] 1-4095 [10] 1-4095 [8]	**t3** **t3** **t3** **t3** **t3**
DS3 Line	CV-L Coding Violations Errored Seconds, Line (ES-L) Severely Errored Seconds, Line (SES-L)	1-16383 [40] 1-900 [25] 1-63 [4]	1-1048575 [3865] 1-65535 [250] 1-4095 [40]	**t3** **t3** **t3**

Operations Interfaces (OI)

This section presents the operations interfaces that are required to support technician access to the system and allow alarms and status information generated by the system to be reported. The local operations interfaces include the CIT interface, the user panel, and the equipment indicators. DDM-2000 OC-12 Multiplexers support office alarms, user-definable miscellaneous discretes, and TL1/X.25.

Craft Interface Terminal (CIT)

The system provides two EIA-232-D compatible CIT interfaces—a front access interface, configured as a DCE, and a rear access CIT interface, configured as a DTE—to allow a permanent modem connection without requiring a null modem. A null modem is required to connect an ASCII terminal to the DTE interface or a modem to the DCE interface. The CIT interfaces provide data rates of 300, 1200, 2400, 4800, 9600, and 19200 baud.

Both CIT interfaces operate full duplex using 1 start bit, 8 data bits, and 1 stop bit. Table 10-15 describes the pins supported on the CIT interfaces:

Table 10-15. CIT Interface Pin Connection

EIA-232-D Pin	Front Access CIT (DCE)	Rear Access CIT (DTE)
Pin 2—Circuit BA Transmitted Data	carries data from terminal to DDM-2000	carries data from DDM-2000 to modem or terminal
Pin 3—Circuit BB Received Data	carries data from DDM-2000 to terminal	carries data from modem or terminal to DDM-2000
Pin 7—Circuit AB Signal Ground	signal ground	signal ground
Pin 8—Circuit CF Received Line Signal Detector	not used	indicates to DDM-2000 that modem or terminal is connected
Pin 20—CIrcuit CD DTE Ready	indicates to DDM-2000 that modem or terminal is connected	indicates to modem or terminal that DDM-2000 is connected (always ON when SYSCTL is powered)

A CIT is recommended for installation, maintenance, and administrative activities. A PC is required for software download and to run CPro-2000 software. The DDM-2000 OC-12 Multiplexer CIT port (mounted on the user panel) is a standard EIA-232-D (supersedes RS-232C specification) interface configured as DCE for direct connection to a CIT. The CIT port will support rates of 300, 1200, 2400, 4800, 9600, and 19200 baud and should be compatible with most *ANSI* 3.64

ASCII terminals; however, it is optimized for standard screens with display areas of 24 lines by 72 (or more) columns. A pager function is included in the DDM-2000 OC-12 Multiplexer to accommodate screen lengths from 3 lines to 150 lines.

Those CITs compatible with DDM-1000 (see 363-206-100 for a list of DDM-1000 compatible terminals) should be directly compatible with the DDM-2000 OC-12 Multiplexer although some may not be as convenient to use with the DDM-2000 OC-12 Multiplexer.

If the multishelf bus cables (ED-8C724-20, G354 or G356) are connected between shelves in a bay, a CIT may then be connected to the user panel CIT port on any shelf and may address any other shelf in that bay (as well as the remote terminal shelves associated with that shelf in the bay). Any terminal compatible with the *ANSI* 3.64 standard should be compatible with the DDM-2000 OC-12 Multiplexer.

Personal Computer Specifications for Software Download

The PC used for software download software should have:

- A minimum of 640K of RAM
- *MS-DOS* version 2.0 or newer
- Hard disk
- At least one floppy disk drive of 360K or larger capacity. Although software download can be done from either floppy or hard disk, a hard disk is preferred for its better performance. The disk requirement is met with most portable *MS-DOS* PCs with a single 3.5-inch disk (720K or larger capacity). An *MS-DOS* PC with a hard disk and either a 3.5-inch 720K or 5.25-inch 360K (or larger) floppy disk may also be used.

Compatible Modems

A compatible modem must meet the following minimum requirements:

- 300, 1200, 2400, 4800, 9600, or 19200 baud
- Full duplex
- 8 data bits
- No parity bits
- 1 start bit
- 1 stop bit
- No flow control.

The following stand-alone modems meet the modem requirements and can be used with the DDM-2000 system. *Western Electric*® 103-compatible and 212A-compatible modems are also suitable for use with the DDM-2000 system. This is not an exhaustive list of compatible modems:

- *Paradyne** 2224-CEO modem (at 1200 and 2400 baud)
- *Paradyne* 2224 modem (at 1200 and 2400 baud)
- *Paradyne* 4024 modem (at 1200 and 2400 baud)
- *Paradyne* 2296 modem (at 4800 and 9600 baud)
- Hayes† *V-series* Smartmodems
- *Penril*‡ Alliance V.32 modem.

The *NCR*§ 3170 computer and the AT&T *Safari** computer have a built-in modem and meet the modem requirements.

* Registered trademark of AT&T.
† Registered trademark of Hayes Microcomputer Products, Inc.
‡ Registered trademark of Penril Corporation.
§ Trademark of NCR Corporation.

CPro-2000 Graphical User Interface and Provisioning Tool

The CPro-2000 Graphical User Interface (GUI) and Provisioning Tool is a *Microsoft*[*] *Windows* based user interface that can optionally be used with the DDM-2000 OC-12 Multiplexer. The tool simplifies and mechanizes administration, maintenance, and provisioning operations. CPro-2000 supports DDM-2000 OC-3 Multiplexers, DDM-2000 OC-12 Multiplexers, and FT-2000 OC-48 Lightwave Systems. A minimum platform configuration is:

- 486 SX *IBM*[†] compatible desktop or laptop PC
- Disk drive — one 1.44 Megabyte (3.5 inch)
- Hard disk with at least 40 Megabytes of available space
- 8 Megabyte RAM
- *MS-DOS* operating system version 5.0 or later
- *Windows* version 3.1, *Windows* NT, or *Windows* 95
- Serial port (EIA-232-D) — configured as COM1 or COM2
- Mouse
- VGA color monitor.

CPro-2000 has been tested with AT&T, *NCR*, *IBM*, *NEC*[‡], and *Gateway*-2000[§] personal computers. For more information, see 365-576-130, *CPro-2000 User Manual,* Release 7.0. See Section 10, "Technical Specifications," for PC requirements to use the tool.

User Panel

The user panel contains red LEDs for CR and MJ alarms, yellow LEDs for MN and PMN alarms, and for abnormal (ABN) and near-end activity (NE-ACTY) status.

A green PWR ON LED is lighted when the shelf is receiving –48 V power. A green ACO LED is lighted when the ACO function is active.

The FE SEL test, ACO/TEST, and UPD/INIT push-buttons are provided to control system operation.

---

* Microsoft is a registered trademark and Windows is a trademark of Microsoft Corporation.

† IBM is a registered trademark of International Business Machines Corporation.

‡ NEC is a registered trademark of NEC Corporation.

§ Gateway 2000 is a trademark of Gateway 2000, Inc.

Equipment Indicators

A red LED FAULT indicator is provided on all circuit packs. A green LED ACTIVE indicator is provided on all 1x1 protected circuit packs to indicate which circuit packs are actively carrying traffic.

Office Alarms

The office alarms interface is a set of discrete relays that control office audible and visual alarms. Separate relays handle CR, MJ, and MN alarms. Each contact closure is rated at 1 A, 60 V, maximum. The CR and MJ alarms can be wire-ORed. The CR alarm relays are fail-safe against unprotected power failures.

User-Definable Miscellaneous Discretes—Environmental Alarms and Controls

The user-definable miscellaneous discrete environmental alarm and control interface allows the DDM-2000 OC-12 Multiplexers to monitor and control equipment at the local site. Twenty-one alarm or status environmental inputs can monitor environmental conditions (for example, open door, high temperature); these inputs are activated by contact closures. The 15th environmental alarm or status input is provided to monitor the condition of the power shelf and fans; this closure is activated by –48 V DC. Four environmental control outputs are provided to control external equipment (for example, pumps or generators). The miscellaneous discrete outputs (control outputs, alarm/status outputs) tolerate –60 V maximum open circuit voltage and 35 mA maximum current. Transient voltages up to –135 V are tolerated for up to 1 ms. The miscellaneous discrete inputs (control inputs at a CO) provide –48 V nominal (–60 V maximum) open circuit voltage and 2 mA maximum current. The miscellaneous discrete output closures generated by the optoisolator require external voltage and ground to operate.

The 21 alarm or status inputs can be reported through a TL1/X.25 interface.

TL1/X.25 Interface

The DDM-2000 Multiplexer supports a TL1/X.25 interface for communication between local and remote DDM-2000 (and FT-2000) NEs and alarm surveillance and provisioning operations systems (OS) such as Bellcore's NMA and OPS/INE OSs. The DDM-2000 OC-12 Multiplexer TL1/X.25 interface is based on Bellcore TR-TSY-000833, Issue 5. The DDM-2000 supports up to nine X.25 permanent virtual circuits (PVCs) and up to nine switched virtual circuits (SVCs) assigned by default as shown in Table 10-16. The user may assign a maximum of nine VCs using any combination of PVCs and SVCs.

Table 10-16. TL1/X.25 Interface — VC Assignments

PVC ID	SVC ID	Logical Group #	Logical Channel #	Default Use
1		0	1	User Definable
2		0	2	Autonomous Maintenance Messages, User Definable
3		0	3	Autonomous Provisioning Messages (REPT DBCHG) User Definable
	1	0	16	User Definable
	2	0	17	User Definable
	3	0	18	User Definable
	4	0	19	User Definable
	5	0	20	User Definable
	6	0	21	User Definable

All VCs support command/response messages. The autonomous maintenance messages are all TL1 autonomous messages except **`REPT DBCHG`**.

If the default assignments in Table 10-16 do not meet the user's OS needs, DDM-2000 allows users to specify the routing of TL1 autonomous message types to VCs. This is done in two steps:

1. Each TL1 autonomous message type (e.g., **`REPT ALM`**, **`REPT DBCHG`**, **`REPT PM`**, etc.) can be mapped to any OS type (using the **`ent-tl1msgmap`** command at every DDM-2000 in the subnetwork). The OS types are tl1Maintenance, tl1MemoryAdministration, tl1test, tl1PeerComm, tl1Other1 and tl1Other2.
2. Each OS type can be mapped to any of the VCs (using the **`ent-osacmap`** command at the DDM-2000 TL1 GNE). The combination of Step #1 (mapping TL1 autonomous message types to OS types) and Step #2 (mapping OS types to VCs) accomplishes the desired mapping of TL1 autonomous message types to VCs.

At the packet layer, DDM-2000 OC-12 Multiplexers are configured as a passive DTE with the following parameters as shown in Table 10-17.

Table 10-17. TL1/X.25 Interface — X.25 Packet Layer Parameters

Parameter	Value
Packet Size	128 bytes or 256 bytes
Window Size	2 packets
D bit support	NO
M bit support	YES

At the link layer, the DDM-2000 OC-12 Multiplexer uses the standard LAPB protocol with the following parameters as shown in Table 10-18.

Table 10-18. TL1/X.25 Interface — LAPB Link Layer Parameters

Parameter	Value
Maximum Frame	2104 bits
Size	8
Modulo	7 frames
Window Size	7 retires
n2	3 seconds
T1	20 seconds
T3	

DDM-2000 OC-12 Multiplexers use synchronous, full duplex, and continuous carrier communication. Data rates of 1200, 2400, 4800, 9600, and 19200 are supported. The EIA-232-D interfaces is configured as DTE, using the pin connections specified in Table 10-19.

Table 10-19. TL1/X.25 Interface - EIA-232-D Pin Connections

Pin	Description
2	Transmitted Data
3	Received Data
4	Request to Send
5	Clear to Send
6	DCE Ready
7	Signal Ground
8	Received Line Signal Detector
15	Transmitted Signal Element Timing (DCE to DTE)
17	Receiver Signal Element Timing (DCE to DTE
20	DTE Ready*

* DTE is always on when system is powered.

Physical Specifications

OC-12 Shelf Physical Characteristics

- Dimensions: 14 in. H x 21.25 in. W x 12 in. D (Group 1)
  Dimensions: 14 in. H x 21.25 in. W x 13.25 in. D (Group 4)
- Weight (Max.): 83 lb. (38 kg)
- Appearance: Coordinated with other equipment in the Lucent 2000 Product Family.

Fan Shelf Physical Characteristics

- Dimensions: 4 in. H x 21.25 in. W x 9 in. D
- Weight (Max.): 20 lb. (9 kg)
- Appearance: Coordinated with other equipment in the Lucent 2000 Product Family.

Network Bay and Cabinet Mounting

DDM-2000 OC-12 Multiplexers can be mounted in ED-8C500, ED-8C501 and ED-8C800, ED-8C801 (seismic) network bay frames. A maximum of three DDM-2000 OC-12 shelves may be mounted in a 7-foot bay. One OC-12 shelf and four OC-3 shelves can be mounted in a 7-foot bay. In addition to bay mounting, DDM-2000 OC-12 can be packaged with other equipment in 80A, 80D, and 80E cabinets, controlled environment vaults (CEVs), or huts.

NOTE:
The mounting brackets on the DDM-2000 OC-3, OC-12, heat baffle, and fan shelf are designed to allow for mounting in standard 23-inch wide network bay frames and 23-inch wide EIA-type bay frames.

Environmental Specifications

Temperature and Humidity

A DDM-2000 OC-12 Multiplexer meets Bellcore's Network Equipment Building System (NEBS*) requirements. A DDM-2000 fan shelf is required in central office environments above every DDM-2000 OC-12 Multiplexer. Refer to ED-8C724-10 and ED-8C727-10, "Typical Bay Arrangements" for detailed information on placement of fans and heat baffles in typical bay arrangements.

The DDM-2000 OC-12 Multiplexer operates in uncontrolled environments at temperatures of –40°C to +75°C and humidity of 5 to 95 percent (noncondensing). Forced convection cooling (fans) is required in all applications. A DDM-2000 OC-12 Multiplexer provides alarming of the 2-type fan units used in Lucent cabinets and alarming of the DDM-2000 fan shelf in controlled environments.

1550 nm Systems

A DDM-2000 OC-12 Multiplexer shelf equipped for 1550 nm applications, using the 23H/23H-U OLIU, must operate in controlled environments at temperatures of 0°C to +49°C and humidity of 5 to 95 percent (noncondensing).

EMC Requirements

The DDM-2000 OC-12 Multiplexer has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio-frequency energy, and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residence is likely to cause harmful interference in which case the user will be required to correct the interference at the user's own expense. The DDM-2000 OC-12 Multiplexer has been tested and fully meets all Bellcore EMC requirements of TR-NWT-001089, Issue 1.

Earthquake Requirements

The DDM-2000 OC-3 Multiplexer meets the earthquake requirements defined in Bellcore TR-NWT-000063, Issue 4, and Pacific Bell Standard PBS-000-102PT. Installation in Zone 4 regions requires that the ED-8C800-50, G1 or

* "NEBS Generic Equipment Requirements," TR-NWT-000063, Issue 4.

ED-8C801-50, G1 seismic Network Bay Frame, and ED-8C812-50, G11 or ED-8C812-50, G12 seismic Network Bay Frame Kit meet the above requirements. For ordering and engineering application information for these frames see drawing ED-8C800-70 and document #065-215-200, respectively.

Fire Resistance

The DDM-2000 OC-12 Multiplexer meets the ignitability requirements specified in T1Y1.4/88-014. In addition, the DDM-2000 OC-12 Multiplexer meets the fire resistance requirements of UL 1459, 2nd Edition.

Underwriters Laboratories

The DDM-2000 OC-12 Multiplexer is *UL* listed for restricted access installations in business and customer premises applications installed in accordance with Articles 110-16 and 110-17 of the *National Electric Code*[*], *ANSI*[†]/NFPA Number 70-87. Other installations exempt from the requirements of the *National Electric Code* may be engineered according to the accepted practices of the local telecommunications utility.

Canadian Standards Association

The DDM-2000 OC-12 Multiplexer has been certified by the Canadian Standards Association per standard C22.2 Number 225-M90.

Power Requirements

Shelf Fuses

The two –48 V feeders (A and B) are required for each DDM-2000 OC-12 shelf. Shelf power is protected by 10-amp fuses provided with the shelf. It is recommended that a supply of spare fuses be provided at DDM-2000 OC-12 Multiplexer locations.

Fuses and a fuse extraction tool can be ordered through Lucent, using Comcode 406203190 for fuses and Comcode 406420273 for the extraction tool, or through SAN-O Industrial Corporation, 91-3 Colin Drive, Sherwood Corporation Center, Holbrook, NY 11741 or by calling 516-472-6666 and ordering:

Fuse, 10-amp, Part No. AX-1-10A or
Fuse Extraction Tool, Part No. F-0431.

---

* Registered trademark of National Fire Protection Association, Inc.

† Registered trademark of National Standards Institution, Inc.

Power Dissipation

The power dissipation figures in Table 10-20 represent **fully loaded** shelves.

- DDM-2000 OC-12 shelf accommodates two –48 V power feeders ("A" and "B" office power feeders).
- Table 10-20 lists the List 1 and List 2 power drain.

Table 10-20. Power Dissipation and Current Drains

Configuration	Power Dissipation (Watts)	DC Current Drains (Amps)	
		L1 (–48V)	L2 (–40V)
Pt-Pt DS3 Terminal * (12 DS3)	177	3.7	4.4
21G/21G-U Optical Hub * (4 OC-3)	201	4.2	5.0
21D/21D-U Optical Hub * (4 OC-3)	193	4.0	4.8
OC-12 Regenerator (4 REGENR circuit packs)	60	1.3	1.5
Pt-Pt EC-1 Terminal * (12 EC-1)	177	3.7	4.4
Ring Shelf * (12 EC-1)	187	3.9	4.7
Ring Shelf * (12 DS3)	187	3.9	4.7
Ring Shelf * E/W 21G/21G-U OLIU (4 OC-3)	211	4.4	5.3
DDM-2000 Fan Shelf	53	1.1	1.3

* These configurations require the DDM-2000 Fan Shelf. Fan power dissipation is listed separately.

The following items should be noted:

- Loss of one power feeder does not cause a loss of service.
- All supply voltages other than –48 V required by the DDM-2000 OC-12 Multiplexer are generated by DC-to-DC converters within the DDM-2000 OC-12 shelf.
- The DDM-2000 OC-12 Multiplexer meets all performance requirements when the DC input voltage varies between –40.0 V and –60.0 V.
- The DDM-2000 OC-12 Multiplexer tolerates DC input voltages between 0 V and –60 V without damage.
- The DDM-2000 OC-12 Multiplexer complies with electrical noise tolerance requirements in Section 13.2 of TR-TSY-000499.

CAUTION:
This information is for a typical application only. Consult 801-525-168, DDM-2000 Floor Plan Data Sheets and T-82046-30, Power Systems DC Distribution Circuit for Digital Transmission System for proper engineering of battery plant and feeders.

DDM-2000 OC-12 Reliability

Summary

This section describes the Bellcore reliability requirements that apply to the DDM-2000 OC-12 Multiplexer and the calculations used to predict how the DDM-2000 OC-12 Multiplexer meets those standards.

The DDM-2000 OC-12 Multiplexer meets all the applicable Bellcore reliability requirements that cover transmission availability, OS availability, silent failures, optical module maintenance, and infant mortality. Table 10-21 summarizes the reliability predictions and requirements. The applicable Bellcore requirements and objective were clarified through interactions with Bellcore during their audit of the DDM-2000 OC-12 Multiplexer. The basis for these requirements comes from TA-TSY-000418, "Generic Reliability Assurance Requirements for Fiber Optic Transport Systems." The method and assumptions used to calculate the DDM-2000 OC-12 Multiplexer reliability predictions are described in the following sections. Each section is devoted to one of the reliability parameters which must meet a Bellcore requirement or objective.

Transmission Availability

Bellcore *requirements* state that the probability of a hardware-caused outage on a two-way channel within a SONET multiplexer should be less than 1.75 minutes per year in a CO environment* and 5.25 minutes per year in a RT environment.† Bellcore *objectives* for outages are 0.25 minutes per year for the CO‡ and 0.75 minutes per year for RT environments.§

The outage requirements and objectives apply to any part of the product needed to process an incoming high-speed or low-speed signal (DS3 to OC-12 or OC-12 to DS3). An outage is defined, for this and all other outage requirements, as any 1-second interval with a bit error rate of 10^{-3} or worse.¶ The predicted hardware outages for various configurations of the DDM-2000 OC-12 system are given in Table 10-21.

A Markov model was used to calculate the predicted system outage. The model assumes a mean time to repair of 2 hours for the CO environment and 4 hours for the RT environment. Individual circuit pack failure rates used in the model were calculated using the method described in TR-TSY-000332, Issue 4, "*Reliability Prediction Procedure for Electronic Equipment (RPP).*" A summary of the circuit

* TA-NWT-000418, Issue 3, November 1991, p. 17.
† TA-NWT-000418, Issue 3, November 1991, p. 28.
‡ TA-NWT-000418, Issue 3, November 1991, p. 18.
§ TA-NWT-000418, Issue 3, November 1991, p. 28.
¶ TR-TSY-000009, Issue 1, May 1986, p. 4-11.

pack and fan shelf failure rates is shown in Table 10-22 and Table 10-23, respectively.

Operation System Interface Availability

The Bellcore objective states that the OS outage should be less than 28 minutes per year (50 percent hardware, 50 percent software).* Therefore, the objective applies to the TL1/X.25 interface. This objective applies to circuitry needed to maintain communication from the DDM-2000 OC-12 Multiplexer to the central office's OS. Since the OS interface is used in the central office, the reliability model assumes the mean time to repair is 2 hours and the environmental factor is 1.0. Table 10-21 lists the predicted outages for the TL1/X.25 interface.

Optical Module Maintenance Objective

According to Bellcore, the objective for mean time between failure (MTBF) of a one-way regenerator is a minimum of 4 years. A regenerator is defined as any circuit packs that perform the electrical-to-optical and optical-to-electrical conversion. The failure rate of the 23G/23G-U OLIU is 11400 FITS according to the RPP method. This translates to a MTBF of 10 years, which meets the objective.

Infant Mortality

Bellcore requires that the number of circuit pack failures in the first year of operation should not exceed 2.5 times the number of failures per year beyond the first year. The ratio of first year failures to failures in subsequent years is known as the infant mortality factor (IMF). The requirement is to have an IMF of less than 2.5. †

DDM-2000 OC-12 Multiplexer circuit packs are subjected to an environmental stress testing (EST) program. The purpose of the program is to eliminate early life failures, conduct failure mode analysis on defective circuit packs, and use corrective action to make the product more reliable. All new circuit pack codes in manufacturing are subjected to EST. However, based on field return data, when the early life failures for any circuit pack codes have been minimal and the infant mortality factor is below 2.5, these circuit pack codes may be subjected only to sampling EST.

---

* TA-NWT-000418, Issue 3, November 1991, p. 36.

† TA-NWT-000418, Issue 3, November 1991, p. 40.

DDM-2000 OC-12 System Reliability Predictions

Table 10-21. DDM-2000 OC-12 System Reliability Prediction (Note 1)

Application	Environment (Note 2)	Bellcore Criteria (Note 3)		Prediction (Outage, min/yr)	MTBF Years (Note 4)
		Requirement	Objective		
DS3 to OC-12	CO	1.75	0.25	0.163	736
DS3 to OC-12	RT	5.25	0.75	0.499	483
EC-1 to OC-12	CO	1.75	0.25	0.253	473
EC-1 to OC-12	RT	5.25	0.75	0.764	314
OC3 to OC-12	CO	1.75	0.25	0.0015	61,900
OC3 to OC-12	RT	5.25	0.75	0.0131	13,760
OS Interface TL1/X.25	CO		14	7.1	16.9

Example:
The unavailability of one two-way DS3 channel within one DDM-2000 OC-12 system configured to multiplex DS3 to OC-12, located in an uncontrolled environment, is 0.499 minutes per year (that is, fraction of time per year when the DS3 channel is unavailable). The mean time between outage of the DS3 channel is 483 years (that is, average length of time until a DS3 outage occurs).

Notes:

1. Hardware failure rates are calculated per the RPP method, TR-NWT-000332, Issue 4, "Reliability Prediction Procedure."
2. The environmental factor for the CO = 1.0 and for the RT = 1.5, per TR-NWT-000332, Issue 4, "Reliability Prediction Procedure."
3. Bellcore criteria (Outage Requirements and Objectives) is based on TA-TSY-000418, Issue 3, "Generic Reliability Assurance Requirements for Fiber Optic Transport Systems." Outage is in minutes per year.
4. Mean time to repair is assumed to be 2 hours for the CO and 4 hours for RT environment.

Table 10-22. DDM-2000 OC-12 Circuit Pack Reliability (Note 1)

	CO		RT	
Circuit Pack	FITS (Note 2)	MTBF (Years)	FITS (Note 2)	MTBF (Years)
BBF2B (TGS)	2311	49.40	3467	32.93
BBF4 (TG3)	*	*	*	*
BBG8 (SYSCTL)	12806	8.91	19208	5.94
BCP3 (TSI)	2692	42.41	4038	28.27
BCP4 (OHCTL)	19240	5.93	28860	3.96
BBG11 (3DS3)	3144	36.31	4716	24.21
BBG11B (3DS3)	3144	36.31	4716	24.21
BBG12 (3STS1E)	2586	44.14	3879	29.43
21D/21D-U (OLIU)	1599	71.39	2399	47.59
21G-U/21G2-U (OLIU)	6348	17.98	9522	11.99
23G (OLIU)	10029	11.38	15044	7.59
23G-U (OLIU)	9023	12.65	13535	8.43
23H (OLIU)	12836	8.89	19254	5.93
23H-U (OLIU)	11552	9.88	17328	6.59

Notes:

1. Calculations are based on Bellcore RPP Issue 4 data. All KS and Lucent components considered as quality level III. All components evaluated at 40°C ambient and 50 percent electrical stress.
2. FITS is the number of failures per billion hours of operation (10^9).

* Not available at time of issue.

Table 10-23. DDM-2000 Fan Shelf Steady State Failure Rates (Based on Bellcore RPP Issue 4 Data)

DDM-2000 Fan Shelf	Failures /10^9 hrs. RPP Prediction	MTBF (years)
ED-8C733,G8 Fan Shelf	9879*	11.56
ED-8C733-30,G6 Fan Unit	2000	57.08

* This includes failure rates for individual fan units.

Commands and Reports

11

Contents

Overview	11-1
Command Page Format	11-1
Input Format	11-2
Addresses	11-3
Command and Prompt Mode	11-6
Special Control Characters	11-7
Paged Reports	11-7
Confirmation Requests	11-8
Output Descriptions	11-8
Alarm Level Prompt	11-8
Security	11-8
Command Menu	11-10
Starting a CIT Session	11-16
CPro-2000	11-16

Commands

APPLY	Apply New Software Generic	11-17
CPY-PROG	Copy Program	11-25
DLT-CRS-STS1	Delete Cross-Connection STS-1	11-32
DLT-CRS-STS3c	Delete Cross-Connection STS-3c	11-35
DLT-OSACMAP	Delete OS App. Context ID Map Entry	11-38
DLT-ULSDCC-L4	Delete Upper Layer Section DCC, Layer 4	11-41
ENT-CRS-STS1	Enter Cross-Connection STS-1	11-44
ENT-CRS-STS3c	Enter Cross-Connection STS-3c	11-50
ENT-OSACMAP	Enter OS App. Context ID Map Entry	11-50
ENT-TL1MSGMAP	Enter TL1 Message Map	11-58
ENT-ULSDCC-L3	Enter Upper Layer Section DCC, Layer 3	11-61
ENT-ULSDCC-L4	Enter Upper Layer Section DCC, Layer 4	11-65
?	Help	11-73
INIT-PM	Initialize Performance Monitoring	11-74

Contents

INIT-SYS	Initialize System	11-75
INS-PROG	Install Program	11-82
LOGOUT	Logout	11-90
OPR-ACO	Operate Alarm Cutoff	11-91
OPR-LPBK-EC1	Operate Loopback EC-1	11-92
OPR-LPBK-T3	Operate Loopback T3	11-94
RESET	Reset	11-98
RLGN	Remote Login	11-100
RLS-LPBK-EC1	Release Loopback EC-1	11-104
RLS-LPBK-T3	Release Loopback T3	11-105
RSTR-PASSWD	Restore Logins and Passwords	11-106
RTRV-ALM	Retrieve Alarm & Status Conditions	11-109
RTRV-ATTR-ALM	Retrieve Attribute Alarm	11-110
RTRV-ATTR-CONT	Retrieve Attribute Control	11-112
RTRV-ATTR-ENV	Retrieve Attribute Environment	11-114
RTRV-CRS-STS1	Retrieve Cross-Connection STS-1	11-116
RTRV-CRS-STS3c	Retrieve Cross-Connection STS-3c	11-119
RTRV-EC1	Retrieve EC-1	11-121
RTRV-EQPT	Retrieve Equipment	11-123
RTRV-FEAT	Retrieve Feature	11-127
RTRV-FECOM	Retrieve Far End Communications	11-128
RTRV-HSTY	Retrieve History	11-130
RTRV-LGN	Retrieve Login	11-131
RTRV-LINK	Retrieve Link	11-133
RTRV-MAP-NEIGHBOR	Retrieve Map Neighbor	11-135
RTRV-MAP-NETWORK	Retrieve Map Network	11-139
RTRV-NE	Retrieve Network Element	11-143
RTRV-OC3	Retrieve OC-3	11-146
RTRV-OC12	Retrieve OC-12	11-149
RTRV-OSACMAP	Retrieve OS App. Context ID Map	11-151
RTRV-PASSWD	Retrieve Password	11-154
RTRV-PM-LINE	Retrieve Performance Monitoring Line	11-156
RTRV-PM-SECT	Retrieve Performance Monitoring Section	11-159
RTRV-PM-STS1	Retrieve Performance Monitoring STS-1	11-162
RTRV-PM-T3	Retrieve Performance Monitoring T3	11-165
RTRV-PM-TCA	Retrieve Performance Monitoring TCA	11-169
RTRV-PMTHRES-LINE	Retrieve Performance Monitoring Threshold Line	11-171
RTRV-PMTHRES-SECT	Retrieve Performance Monitoring Threshold Section	11-173
RTRV-PMTHRES-STS1	Retrieve Performance Monitoring Threshold STS-1	11-175
RTRV-PMTHRES-T3	Retrieve Performance Monitoring Threshold T3	11-177
RTRV-SECU	Retrieve Security	11-180
RTRV-STATE-EQPT	Retrieve State Equipment	11-183
RTRV-STATE-OC3	Retrieve State OC-3	11-188
RTRV-STATE-PATH	Retrieve State Path	11-190

Contents

RTRV-STATE-STS1	Retrieve State STS-1	11-193
RTRV-STATE-STS3c	Retrieve State STS-3c	11-195
RTRV-STS1	Retrieve STS-1	11-197
RTRV-STS3c	Retrieve STS-3c	11-200
RTRV-SYNC	Retrieve Synchronization	11-202
RTRV-T3	Retrieve T3	11-212
RTRV-TL1MSGMAP	Retrieve TL1 Message Map	11-216
RTRV-TRACE-STS1	Retrieve Path Trace STS1	11-219
RTRV-ULSDCC-L3	Retrieve Upper Layer Section DCC, Layer 3	11-222
RTRV-ULSDCC-L4	Retrieve Upper Layer Section DCC, Layer 4	11-225
RTRV-X25	Retrieve X.25 Link	11-231
SET-ATTR-ALM	Set Attribute Alarm	11-235
SET-ATTR-CONT	Set Attribute Control	11-237
SET-ATTR-ENV	Set Attribute Environment	11-239
SET-DATE	Set Date	11-241
SET-EC1	Set EC-1	11-243
SET-FEAT	Set Feature	11-245
SET-FECOM	Set Far End Communications	11-248
SET-LGN	Set Login	11-252
SET-LINK	Set Link	11-259
SET-NE	Set Network Element	11-260
SET-OC3	Set OC-3	11-263
SET-OC12	Set OC-12	11-267
SET-PASSWD	Set Password	11-269
SET-PMTHRES-LINE	Set Performance Monitoring Threshold Line	11-273
SET-PMTHRES-SECT	Set Performance Monitoring Threshold Section	11-277
SET-PMTHRES-STS1	Set Performance Monitoring Threshold STS-1	11-279
SET-PMTHRES-T3	Set Performance Monitoring Threshold T3	11-282
SET-SECU	Set Security	11-289
SET-STATE-EC1	Set State EC-1	11-292
SET-STATE-OC3	Set State OC-3	11-294
SET-STATE-STS1	Set State STS-1	11-296
SET-STATE-STS3c	Set State STS-3c	11-299
SET-STATE-T3	Set State T3	11-301
SET-STS1	Set STS-1	11-303
SET-STS3c	Set STS-3c	11-306
SET-SYNC	Set Synchronization	11-309
SET-T3	Set T3	11-315
SET-TRACE-STS1	Set Path Trace STS-1	11-319
SET-X25	Set X.25 Link	11-322
SWITCH-FN	Protection Switch Function Unit	11-324
SWITCH-PATH-STS1	Switch Path STS-1	11-326
SWITCH-PATH-STS3c	Switch Path STS-3c	11-330

Contents

SWITCH-SYNC	Protection Switch Synchronization	11-334
TEST-ALM	Test Office Alarm	11-338
TEST-LED	Test LED Indicators	11-340
TEST-SYSCTL	Test System Controllers	11-341
TEST-TRMSN-T3	Test Transmission T3	11-343
TOGGLE (Ctl-T)	Toggle	11-348
UPD	Update	11-350

Detailed Alarm and History Reports

Introduction	11-355
RTRV-ALM	11-356
RTRV-HSTY	11-373

Commands and Reports

11

Overview

This chapter describes the command and report features of the American Standard Code for Information Interchange (ASCII) terminal interface to a DDM-2000 OC-12 Multiplexer. It provides detailed information about each command, as well as system report outputs and explanations.

Reason for Issue

This chapter provides the details of software commands for OC-3 Release 7.0. This release features Target ID Address Resolution Protocol (TARP) which provides for multi-vendor interworking. With this feature, some commands available in earlier releases are no longer applicable. Similarly, there are several new commmands in Release 7.0 not available in earlier releases. For additional information on TARP, please refer to the “About This Document” section.

Command Page Format

This chapter includes DDM-2000 commands that are presented as one- or multiple-page entires in alphabetical order. The name of each command appears at the top of each page.

Each entry is presented in a common format:

— The **NAME** part gives the name of the command and summarizes its funtion.

— The **INPUT FORMAT** provides the syntax for each command. Each command starts with a command name followed by a colon. Parameters follow the colon. Optional parameters are enclosed in square brackets [ ].

— The **DESCRIPTION** part provides detailed information about each command.

— The **RELATED COMMANDS** part identifies commands that affect or are affected by the named command or sets the conditions displayed by a report. Some commands are not affected by any other command and will not have this part included on the command page.

Entries which are to be typed exactly as shown are printed in **bold** type. System repsonses are printed in courier type. Descriptive names entry values are shown in *italic* type.

Input Format

All commands have a common input format:

command name[:Address][:parameters]

Address identifies a slot, channel, or operations interface within the shelf. In commands which require an address, it must appear immediately after the command name.

Parameters identifies a variable name assigned to some provisionable attribute of the command. The value of the parameter is defined on each command page.

Parameters are separated with commas (,). The parameters may be entered in *any* order, but they must be entered in the *name=value* format.

Brackets ([ ]) are not part of the command line. Parameters enclosed in brackets are optional. Default values are provided for these parameters.

Any command can be entered on a single line.

DDM-2000 is case sensitive. Commands may be entered in upper- and lower-case letters. Entries other than commands may be case sensitive (for example, passwords). DDM-2000 addresses and logins are sensitive to white space (that is, blanks between characters). For example, the address parameters "**m1-all**" and "**m1- all**" may be interpreted differently by DDM-2000. As a general rule, white space should not be included in commands.

Addresses

Table 11-1 specifies the valid addresses for slots, lines, ports, channels, paths, cross-connections, and operations interfaces. Where lists of items appear in braces { }, and one (and only one) of these items may be used to form the address.

Each address is made up of several components that are combined to indicate a specific location on the DDM-2000. The following list shows the potential values for each address component. Refer to this list when reviewing Table 11-1:

slot type: Possible values are: `main, m, fn, ls, tg, sysctl, auxctl, tsi, userpanel,` and `all`.

group: Possible values are: `m, a, b, c, d,` and `all`.

Note carefully in Table 11-1 when this value is followed by a dash (-) and when it is not.

slot within a group (abbreviated as slot):

Possible values are: `1-8,` and `all`.

line: Possible values are: `1, 2` and `all`.

This identifies a line within a slot. Note carefully in Table 11-1 when `all` is not allowed.

STS-1: Possible values are: `1-12`, and `all`.

special: Possible values are: `cit, dcc, tbos, partlm, x25, env, cont, lan,` and `ref.`

environmental alarm or control point (abbreviated as alm/cont point):

Possible values are: `1-21,` and `all`.

Table 11-1. DDM-2000 OC-12 Address Table

Object	Entity	Address	Example
Slots	Entire System	all	all
	Main slot	main-{a,b,all*}-{1,2,all}	main-all
	TSI unit slot	tsi-{1,2,all}	tsi-1
	Function unit slot	fn-{a,b,c,d,all*}-{1,2,all}	fn-all fn-b-all fn-d-1
	Timing slot	tg-{1,2,all}	tg-all
	Sys. control slot	sysctl	sysctl
	Aux. control slot	auxctl	auxctl
Lines	OC-12 line pair	all main-{b,all}	all main-b
	OC-12 line	all main-b-{1,2,all}	all main-b-1
	OC-3 line pair	all fn-{a,b,c,d,all}	all fn-b
	OC-3 line	all fn-{a,b,c,d,all*}-{1,2,all}	all fn-c-2
Ports	DS-3 port	{a,b,c,d,all*}-{1-3,all}	a-2
	DS1 sync. ref. port	ref-{1,2}	ref-1
	EC-1 port	{a,b,c,d,all*}-{1-3,all}	b-3
Channels	STS-1 channel (within OC-12)	{mb,all*}-{1-12,all} mb{1,2}-{1-12}	mb-4 mb1-4
	STS-1 channel (within OC-3)	{a,b,c,d,all*}-{1-3,all}	c-1 b-3
	STS-3c channel (within OC-12)	mb-{1,4,7,10},all mb{1,2}-{1,4,7,10,all}	mb-4 mb1-1
STS-1 Cross-Connections	Main	mb-{1-12,all}	mb-8
	Function unit	{a,b,c,d}-{1-3,all}	b-1
	3STS1E port	{a,b,c,d}-{1-3,all}	a-2
	3DS3 port	{a,b,c,d}-{1-3,all}	c-1
	Function Unit (OLIU)	{a,b,c,d}-{1-3,all}	d-3

* If all is chosen as any part of an address, no subsequent address fields should be defined.

(Table continues on the following page)

Table 11-1. DDM-2000 OC-12 Address Table

Object	Entity	Address	Example
Operation Interfaces	User Panel	userpanel	userpanel
	CIT	cit-{1,2,all}	cit1
	Section Data Comm Channel	dcc-{mb,a,b,c,d,all*}{1,2} (Rings, fecom only) dcc-all (Rings security, R5.0 and later)	dcc-mb2 dcc-all
	TBOS	tbos-1	tbos-1
	X.25 link	x25	x25
	IAO LAN interface	lan	lan
	Environmental Alarm Input	env-{1-21,all}	env-2
	Environmental Control Input	cont-{1-4,all}	cont-1

* If all is chosen as any part of an address, no subsequent address fields should be defined.

The 2000 Product Family includes many SONET products that are capable of interworking with each other. At times, references to other SONET products may appear in DDM-2000 reports. The following list shows standard abbreviations for the various members of the 2000 family.

Complete Product Name	Abbreviated Product Name
unknown	unknown*
DDM-2000 OC-3	DDM-OC3
DDM-2000 OC-12	DDM-OC12
DACS IV-2000	DACS-IV
FT-2000	FT-2000
SLC-2000 Access System	SLC-2000
DDM-2000 FiberReach	FbrRch
Foreign	Foreign**

* Indicates the type of product is unknown.

** Indicates that the product is not compatible with other SONET products.

Command Mode and Prompt Mode

There are two entry modes: command mode (no prompts) and prompt mode. In the command mode (the default), the command line and any user responses are terminated by the semicolon (;) or carriage return (<cr>).

The prompt mode is designed for users that are not familiar with DDM-2000. To enter the prompt mode, terminate any line with a carriage return (ENTER or RETURN key) or question mark (?). Prompts generally appear in the form:

```
Prompt Message [Default value]=
```

with the default value enclosed in square brackets ([..]). There are two types of default values:

Static default values, which assume the same value each time the command is invoked.

Current default values, which reflect the mode recent value entered into the system. In the case of an address containing the value “all”, the prompt will display the value [CurrentValues]. When “Current Values” is selected, the current setting of that parameter is not changed.

To reenter the command mode from the prompt mode, answer the current prompt, then continue entering input on the same line after typing a comma (,). When the input is completed, terminating the command with a semicolon (;) will return the session to the command mode. If a command is terminated with a semicolon (;), the system will use default values for all optional parameters for which a value has not been given.

The **help** command provides in-context help during a dialog with DDM-2000. Help is provided automatically when an invalid input is entered and can also be requested anytime by typing a question mark (?).

Special Control Characters

The following characters have special meaning when used with DDM-2000:

- Backspace characters control H (^H), BACKSPACE key is used to erase character input.
- At sign (@) is used to erase an entire line of input.
- Question mark (?) is used to get help and to enter prompt mode at any time.
- Comma (,) is used to separate parameters from each other.
- Equal sign (=) is used to separate parameter names from parameter values.
- Control T (^T) is the **toggle** command. See the **toggle** command page for additional details.
- Carriage return (ENTER or RETURN key) or exclamation point (!) are used to end a line of input.
- Semicolon (;) is used to end a command. The system will use default values for all optional parameters for which a value has not been given.
- CANcel, DELete, and CTRL-x are used to abort a command which has been entered but has not yet started to execute. All commands can be aborted anytime before the “In Progress...” message is printed. Test commands (except **test-sysctl**) can be aborted at any time during execution using these keys. Reports may be aborted at any time using these keys.
- Colon (:) is used to separate the command name, address, and parameters.

Paged Reports

Reports are paged. When the end of the page has been reached, the prompt “`more? [yes]=`” is displayed if more report text remains. Page length can be set with the **set-link** command.

Confirmation Requests

NOTE: Some commands can be service-affecting if their default parameters are ignored.

After all parameters have been entered, a caution message followed by the command name, the selected values of parameters, and the prompt "`Execute? (y/n or CANcel/DELete to quit)=` is printed. To execute the command, enter "y" and carriage return. To change the value of any of the parameters, enter "n" and carriage return and you will be reprompted for all parameters. To abort the command, enter CANcel or DELete.

Output Descriptions

The output for most commands is described on the following manual pages. Refer to the "Detailed Alarm and History Reports" part of this section for more complete examples and explanations of the alarm and status report (**`rtrv-alm`**) and the history report (**`rtrv-hsty`**).

Alarm Level Prompt

When the system is ready to accept a new command, it prints the system prompt "<". If there is an active alarm or status condition, the level of the highest level active alarm in the system is printed before the "<". For example, the system prompt is "MN<" when a minor alarm condition exists in the system.

Security

The option of system security is provided for DDM-2000 systems. Three privileged user logins and a maximum of 100 nonprivileged user logins, consisting of general users, maintenance users, and Reports-Only users, are available. Privileged users may set system security on all data communication channels (DCC) and each craft interface terminal (CIT) interface (using the **`set-secu`** command) and assign login and password pairs to general users (using the **`set-lgn`** command). General users may execute commands that are not restricted to privileged users and obtain reports. Maintenance users may only execute commands that access the system, extract reports, and execute maintenance functions. Reports-Only users may only obtain reports and ececute several basic commands.

When system security is enabled, all users are then required to enter a valid login and password pair to access the system.

The following comands are always restricted to privileged users only:

- **init-sys** (initialize system)
- **rstr-passwd** (restore password)
- **rtrv-lgn** (retrieve login)
- **rtrv-passwd** (retrieve password)
- **set-fecom** (set far-end communication)
- **set-lgn** (set login)
- **set-secu** (set security)
- **set-feat** (set feature)
- **set-sync** (set synchronization)

When security is enabled on a system, the following commands become restricted to priviliged users only:

- **cpy-prog** (copy program)
- **dlt-osacmap** (delete OS application context ID map entry)
- **ent-osacmap** (enter OC application context ID map entry)
- **ent-ulsdcc-l3** (enter upper layer section DCC, Layer 3)
- **ent-ulsdcc-l4** (enter upper layer section DCC, Layer 4)
- **ent-tl1msgmap** (enter TL1 message map for Operations Systems)
- **init-pm** (initialize performance montoring)
- **ins-prog** (install program)
- **reset** (reset system software)
- **set-date** (set date)
- **set-ne** (set network element)
- **set-x25** (set X.25 link)

When security is enabled on a system, only the following commands may be executed by Reports-Only users:

- **?** (help)
- **logout** (log out)
- **rlgn** (remote login)
- **set-link** (set link)
- **set-passwd** (set password)
- **T** (toggle)
- all **rtrv** commands except **rtrv-lgn** and **rtrv-passwd**

Refer to the **set-secu** command for more details on system security.

DDM-2000 OC-12 Command Menu

Table 11-2 lists the DDM-2000 OC-12 commands by category and indicates what type of user is able to execute each command.

Table 11-2. DDM-2000 OC-12 Command Menu

Command Category	Verb	Modifier	Security Level
CONFIGURATION	rtv-	alm	Privileged, General, Maintenance, Reports only
		state-eqpt	Privileged, General, Maintenance, Reports only
		state-path	Privileged, General, Maintenance, Reports only
		state-sts1	Privileged, General, Maintenance, Reports only
		state-vt1	Privileged, General, Maintenance, Reports only
		state-oc1	Privileged, General, Maintenance, Reports only
		eqpt	Privileged, General, Maintenance, Reports only
		feat	Privileged, General, Maintenance, Reports only
		fecom	Privileged, General, Maintenance, Reports only
		hsty	Privileged, General, Maintenance, Reports only
		oc3	Privileged, General, Maintenance, Reports only
		oc12	Privileged, General, Maintenance, Reports only
		t3	Privileged, General, Maintenance, Reports only
		ec1	Privileged, General, Maintenance, Reports only
		sync	Privileged, General, Maintenance, Reports only
		link	Privileged, General, Maintenance, Reports only
		attr-alm	Privileged, General, Maintenance, Reports only
		attr-cont	Privileged, General, Maintenance, Reports only
		attr-env	Privileged, General, Maintenance, Reports only

Table 11-2. DDM-2000 OC-12 Command Menu (Contd)

Command Category	Verb	Modifier	Security Level
CONFIGURATION (Continued)		ne	Privileged, General, Maintenance, Reports only
		map-neighbor	Privileged, General, Maintenance, Reports only
		map-network	Privileged, General, Maintenance, Reports only
		osacmap	Privileged, General, Maintenance, Reports only
		crs-sts1	Privileged, General, Maintenance, Reports only
		crs-sts3c	Privileged, General, Maintenance, Reports only
		ulsdc-l3	Privileged, General, Maintenance, Reports only
		ulsdcc-l4	Privileged, General, Maintenance, Reports only
		sts1	Privileged, General, Maintenance, Reports only
		sts3c	Privileged, General, Maintenance, Reports only
		tl1msgmap	Privileged, General, Maintenance, Reports only
		trace-sts1	Privileged, General, Maintenance, Reports only
		x25	Privileged, General, Maintenance, Reports only
	set-	oc3	Privileged, General
		oc12	Privileged, General
		sts3c	Privileged, General
		t3	Privileged, General
		ec1	Privileged, General
		sync	Privileged
		date	Privileged only if Security enabled. Privileged, General if Security disabled.
		link	Privileged, General, Maintenance, Reports only
		attr-alm	Privileged, General
		attr-cont	Privileged, General
		attr-env	Privileged, General

Table 11-2. DDM-2000 OC-12 Command Menu (Contd)

Command Category	Verb	Modifier	Security Level
	set-	ne	Privileged only if Security enabled. Privileged, General if Security disabled.
		state-t3	Privileged, General
		state-ec1	Privileged, General
		state-oc3	Privileged, General
		state-sts1	Privileged, General
		state-sts3c	Privileged, General
		fecom	Privileged
		feat	Privileged
		sts1	Privileged, General
		sts3c	Privileged, General
		trace-sts1	Privileged, General
		x25	Privileged only if Security enabled. Privileged, General if Security disabled.
CONFIGURATION	upd		Privileged, General
(Continued)	init-	sys	Privileged
	switch-	fn	Privileged, General, Mainenance
		sync	Privileged, General, Mainenance
		path-sts1	Privileged, General, Mainenance
		path-sts3c	Privileged, General, Mainenance
	opr-	lpbk-t3	Privileged, General, Mainenance
		lpbk-ec1	Privileged, General, Mainenance
	rls-	lpbk-t3	Privileged, General, Mainenance
		lpbk-ec1	Privileged, General, Mainenance
	test-	auto	Privileged, General, Mainenance
		trmsn-t3	Privileged, General, Mainenance
		alm	Privileged, General, Mainenance
		led	Privileged, General, Mainenance
		sysctl	Privileged, General, Mainenance

Table 11-2. DDM-2000 OC-12 Command Menu (Contd)

Command Category	Verb	Modifier	Security Level
CONFIGURATION (Continued)	ins-	prog	Privileged only if Security enabled. Privileged, General if Security disabled.
	ent-	crs-sts1	Privileged, General
		crs-sts3c	Privileged, General
		usldcc-l3	Privileged only if Security enabled. Privileged, General if Security disabled.
		usldcc-l4	Privileged only if Security enabled. Privileged, General if Security disabled.
		tl1msgmap	Privileged only if Security enabled. Privileged, General if Security disabled.
		osacmap	Privileged only if Security enabled. Privileged, General if Security disabled.
	dlt-	crs-sts1	Privileged, General
		crs-sts3c	Privileged, General
		osacmap	Privileged only if Security enabled. Privileged, General if Security disabled.
	cnvt-	crs	Privileged, General
	cpy-	prog	Privileged only if Security enabled. Privileged, General if Security disabled.
FAULT	rtrv-	alm	Privileged, General, Mainenance, Reports-Only
		state-eqpt	Privileged, General, Mainenance, Reports-Only
		state-path	Privileged, General, Mainenance, Reports-Only
		eqpt	Privileged, General, Mainenance, Reports-Only
		hsty	Privileged, General, Mainenance, Reports-Only
	opr-	aco	Privileged, General, Mainenance, Reports-Only
	reset		Privileged, General, Mainenance, Reports-Only

Table 11-2. DDM-2000 OC-12 Command Menu (Contd)

Command Category	Verb	Modifier	Security Level
PERFORMANCE	rtrv-	pm-tca	Privileged, General, Mainenance, Reports-Only
		pm-sect	Privileged, General, Mainenance, Reports-Only
		pm-line	Privileged, General, Mainenance, Reports-Only
		pm-t3	Privileged, General, Mainenance, Reports-Only
		pm-sts1	Privileged, General, Mainenance, Reports-Only
		pmthres-sect	Privileged, General, Mainenance, Reports-Only.
		pmthres-line	Privileged, General, Mainenance, Reports-Only.
		pmthres-sts1	Privileged, General, Mainenance, Reports-Only.
		pmthres-t3	Privileged, General, Mainenance, Reports-Only.
		alm	Privileged, General, Mainenance, Reports-Only.
		state-eqpt	Privileged, General, Mainenance, Reports-Only.
		state-path	Privileged, General, Mainenance, Reports-Only.
		eqpt	Privileged, General, Mainenance, Reports-Only.
		hsty	Privileged, General, Mainenance, Reports-Only.
	set-	pmthres-sect	Privileged, General, Mainenance, Reports-Only.
		pmthres-line	Privileged, General, Mainenance, Reports-Only.
		pmthres-sts1	Privileged, General, Mainenance, Reports-Only.
		pmthres-t3	Privileged, General, Mainenance, Reports-Only.
	init-	pm	Privileged only if Security enabled. Privileged, General if Security disabled.

Table 11-2. DDM-2000 OC-12 Command Menu (Contd)

Command Category	Verb	Modifier	Security Level
SECURITY	rtrv-	lgn	Privileged
		secu	Privileged, General, Mainenance, Reports-Only.
		passwd	Privileged
	set-	lgn	Privileged
		secu	Privileged
		passwd	Privileged, General, Mainenance, Reports-Only.
	rstr-	passwd	Privileged
MISCELLANEOUS	apply		Privileged
	help		Privileged, General, Mainenance, Reports-Only.
	logout		Privileged, General, Mainenance, Reports-Only.
	rlgn		Privileged, General, Mainenance, Reports-Only.
	toggle		Privileged, General, Mainenance, Reports-Only.

Starting a CIT Session

Procedures in the “Operation and Maintenance” section of this manual describe how to “Connect a CIT and Establish a Session” with the DDM-2000.

CPro-2000

CPro-2000 is a software package from Lucent Technologies to help users of DDM-2000 Multiplexer systems set up and use an advanced, yet simple, craft operations environment on a personal computer using *Microsoft* Windows**3.1 in the enhanced mode. CPro-2000 provides the user with the normal CIT access to DDM-2000 as well as a mouse-driven graphical user interface (GUI). The user may issue commands to DDM-2000 by using the mouse to select items from a menu and/or objects from the graphics display.

CPro-2000 Release 3.0 and later supports DDM-2000 OC-3,OC-12 and FiberReach Multiplexers, as well as FT-2000 OC-48 Systems. For complete information on CPro-2000, refer to the *CPro-2000 User Manual*, 190-253-101 (for CPro-2000 Release 3.0) or 365-576-1xx (for CPro-2000 Release 4.0 and later).

Commands

The following pages provide detailed information about the user interface commands supported by DDM-2000. Detailed report information is located at the end of this chapter.

* Registered trademark of Microsoft Corporation.

NAME

apply: Locally Overwrite the Executing Software Generic with a New Software Generic

INPUT FORMAT

apply[:[date=*date*][,[time=*time*][,action=*action*]]];

DESCRIPTION

This command can be issued by the user to initiate the installation of a dormant copy of a software generic stored in the network element's flash memory; therefore replacing the currently executing software generic.

Once the **apply** command completes, the software in flash memory is left undisturbed, so that it can be copied to other like network elements.

CAUTION:
Normal alarming and protection switching are disabled for the DDM-2000 system while this command is used to copy the dormant program.

NOTE:
This command is available to privileged users only for all CIT or DCC ports on the system.

Users can schedule a date and time for this command to be executed. If no date and time is supplied, the command will execute 15 minutes after it is received.

All users can remotely apply the dormant software generic to be the executing one by first remotely loging into the target network element and then initiating this command.

The input parameters are:

date Date is entered as six digits YYMMDD, where YY represents the last two digits of the year, MM is the month, and DD is the day. Default is the current system day. If no *date* parameter is entered, and **action** has the value of **install** or is **NULL**, and the entered value for *time* has already passed the 24-hour interval in the current system's date, *date* will default to the next system's day (current system's day + 1). (As an example, if the current time is 23:46 but the provisioned time is set for 21:00, the execution of the command will occur at 21:00 the next system's day.)

time The time parameter is supplied in order to identify the time at which the software is to be installed on the network element. If no *time* parameter is entered, and the *action* parameter has the value of **install** or is **NULL**, then the software will be scheduled for installation 15 minutes after receiving the **apply** command. The fifteen-minute interval is designed to give the user a chance to cancel the command and/or to issue similar command(s) to other network element(s) in the subnetwork.

This parameter is entered as six digits **HHMM[SS]**. **HH** expresses the hour on a 24-hour clock basis and the allowed values range from **00** to **23**, with leading zeros required. **MM** expresses the minutes and the allowed values range from **00** to **59** with leading zeros required. **SS** expresses the seconds and the allowed values are **NULL** or a value ranging from **00** to **59** with leading zeros required.

action The action parameter enables the execution of this command to be either confirmed, or canceled. The allowed values are:

install This action causes the installation of software at the time and date supplied in the *time* and *date* parameters. The installation will take place in 15 minutes if *time* and *date* are not provisioned.

cancel Cancel the scheduled installation.

NULL No value. When no value is entered, the default value is **install**.

If a software installation was already scheduled, and a **cancel** value was received, the software installation is canceled.

CAUTION:
If this command is scheduled for execution (*action*=**install**), the **set-date** command should never be issued before program installation is invoked and completed. In this case, the user is advised to wait until program installation is completed, and the system is reset.

NOTE:
If this command is issued with (*action*=**install**), while there is an outstanding apply command, the newly issued command will replace the old request with the newly entered values of **date** and **time**.

If this command is entered by a non-privileged user, the following denial message is displayed:

```
PICC
/* Privileged, Illegal Command Code. */
```

If the command syntax is correct, the following message will be displayed:

```
/* Testing for program copy ... */
```

If an **apply** command is issued to schedule (install or NULL) a software installation but **time** is entered with invalid syntax, the user will be reprompted to enter a valid **time** value.

If an **apply** command is issued to schedule (install or NULL) a software installation but **date** is entered with invalid syntax, the user will be reprompted to enter a valie **date** value.

If the time specified is unknown to the local system, the following denial message will be displayed:

```
IDNV
/* Input Data Not Valid */
/* Unknown time specified. */
```

If the date specified is unknown to the local system, the following denial message will be displayed:

```
IDNV
/* Input Data Not Valid */
/* Unknown date specified. */
```

If this command is issued and the dormant copy of software generic is either missing (does not reside in the flash memory) or is determined to have been corrupted, the following denial message is displayed:

```
SROF
/* Status, Requested Operation Failed */
/* Dormant file corrupted or missing. */
```

If an otherwise valid command with action equal to **`cancel`** is initiated, but with no outstanding apply command, the request will be denied and the following message displayed:

```
SROF
/* Status, Requested Operation Failed */
/* No apply command to cancel. */
```

After testing for program apply, the following confirmation message will be displayed:

```
/* Caution! Execution of this command will erase the current
   generic n.n.n at Target Identifier and replace it with
   generic m.m.m.  If this fails prior to completion,
   the control system will likely become inoperable
   until another install program attempt is successful.
   This command will terminate any active CIT and TL1 sessions.
   This command will take time to install the new program.  Check
   the Software Release Description for the time estimates. */


   You have selected the apply command with these parameters:

   date = date
   time = time
   action = action


Execute? (y/n or CANcel/DELete to quit) =
```

When this command is used to install a new release of program that is significantly different from the program currently running on the system, the following confirmation message will be displayed after testing for program apply:

```
/* Caution! Execution of this command will erase the current
   generic n.n.n at Target Identifier and replace it with
   generic m.m.m.  If this fails prior to completion,
   the control system will likely become inoperable
   until another install program attempt is successful.
   This command will terminate any active CIT and TL1 sessions.
   Check the Software Release Description for the time estimates. */

/* Caution! Major changes exist between these two generics such
   that they may not be compatible.  Check the TOPS and program
   compatibility information for additional information or actions
   needed. */


   You have selected the apply command with these parameters:

   date = date
   time = time
   action = action


Execute? (y/n or CANcel/DELete to quit) =
```

See "Install New Generic Program" in the TOP section (Volume 2) of this manual for complete instructions before using this command. Use the **`rtrv-map-network`** command to obtain the exact TID for the target system. The current program version may also be obtained from the initial screen when logged into the system with a craft interface terminal (CIT).

When the user gives a positive response to the confirmation message, the following message is displayed:

```
In progress; Program installation will start on <date>, at
<time>.
System will Reset when program installation is complete.
```

After displaying the above message, the program apply will begin at the provisioned **`date`** and **`time`**.

If the program apply fails, the following failure message will be displayed:

```
SSTP
/* Status, execution STOPped */
/* Program apply failed. Target Identifier
   will restart its current program, if possible.
   Before attempting another apply, check the User's Manual
   to review a list of possible problems and their solutions. */
```

If this command is issued with action equal to **cancel**, the following confirmation message will be displayed:

```
/* Caution! Execution of this command will cancel the scheduled
   software installation at Target Identifier.


   You have selected the apply command with this parameter:

   action = cancel


Execute? (y/n or CANcel/DELete to quit) =
```

NOTE:
When the value **cancel** is entered for Action, the user will not be prompted for the (date and time) parameters. As soon as the scheduled program installation is canceled as a result of this option, the Date and Time are initialized to zero (0) values.

When the user gives a positive response to the confirmation message, the following message is displayed:

```
Program installation is being canceled.
```

Once the program installation is canceled, the following message is displayed:

```
COMPLD
```

RELATED COMMANDS

cpy-prog

ins-prog

rtrv-ne

NAME

cpy-prog: Copy Program

INPUT FORMAT

cpy-prog:*TID;*

DESCRIPTION

This command is used to copy a software program from one DDM-2000 network element to another. The software to be copied may be a non-executing, dormant copy of a software generic. When executing this command, the local network element will internally check whether the currently executing software generic or a dormant software generic should be copied into the memory of the target network element, where it would reside as a dormant copy also. The **apply** command is used later to overwrite the currently executing generic with a copy of the generic included in the dormant software.

NOTE:
If security is enabled on any CIT or DCC port on a system, then this command is available to privileged users only for all CIT or DCC ports on the system. If security is not enabled on *some* systems in the network, users on unsecured systems will be able to copy either executing or dormant program onto systems with security enabled.

The input parameter for all releases of this command is:

TID The Target Identifier (system name) of the system into which the program will be loaded. TIDs are case insensitive.

If the command syntax is correct, the following message will be displayed:

```
/* Testing for program copy ... */
```

If the system name specified is the name of the local system instead of the remote system, the following error message will be displayed and the user will be asked to reenter the TID:

```
/* Invalid Target Identifier (TID) */
/* Enter the name (TID) of the far end system. */
TID=
```

If a user attempts to copy program from one product type to a different product type (for example, DDM-2000 OC-12 program into an FT-2000 system), the following denial message will be displayed:

```
IITA
/* Input, Invalid TArget identifier (TID) */
/* <TID> is a different product type;
   Incompatible software. */
```

The above message is displayed before any association is established between the local and target network elements (NEs).

If the remote system has a communication failure or a "P" is displayed in the SYSCTL 7-segment LED display, the following denial message will be displayed:

```
SSTP
/* Status, execution SToPped */
/* Communication failure. */
```

If a Network Element (NE) receives this command, but is unable to determine a TID-NSAP translation for the entered TID (TID could not be found), this command will be denied and the following message displayed:

```
SNVS
/* Status, Not in Valid State */
/* Remote session cannot be established.
   TID entered is not found. */
```

If the remote NE's TID does not match the entered TID (only the NSAP matched in this case), this command will be denied and the following message displayed :

```
SNVS
/* Status, Not in Valid State */
/* Remote session cannot be established.
   Inconsistent TID.
   NSAP=XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX */
```

If an NE receives this command and is able to determine a TID-NSAP translation, but the NSAP is unreachable (TID is kept the same, but NSAP must have been changed), this command will be denied and the following message displayed:

```
SNVS
/* Status, Not in Valid State */
/* Remote session cannot be established.
   Association setup failure.
   NSAP=XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX */
```

In the above message, NSAP represents the one found in the TID-NSAP translation.

If the dormant copy is either corrupted or not found, and it is the only software generic that can be copied, the following denial message is displayed:

```
SROF
/* Status, Requested Operation Failed */
/* Dormant file corrupted or missing. */
```

A user should not attempt to copy program from an OC-12 shelf using Release 5.1 or later (a release capable of receiving, storing, or sending compressed files) into a remote OC-12 shelf using Release 5.0 or earlier (a release that is not capable of receiving compressed files). The currently executing software generic cannot be copied to the destination network element because it has a different release number from the dormant copy. The copy request will be denied and the following message is displayed:

```
SROF
/* Status, Requested Operation Failed */
/* Execute APPLY command locally first and then try again. */
```

The above request is denied because no copy from the source NE to the destination NE is possible until the executing software release number matches the dormant software release number. To correct this problem, the **`apply`** command must be issued in the source NE first before trying again.

The following confirmation message will be displayed when this command is entered:

```
/* Caution! Execution of this command will overwrite the current
   dormant generic (if any) at Target Identifier. */

Execute? (y/n or CANcel/DELete to quit) =
```

When this command is used to copy a new release of program (into the dormant memory of remote system) that is significantly different from the program currently running on the system, the following confirmation message will be displayed after testing for program copy:

```
/* Caution! Execution of this command will overwrite the current
   dormant generic (if any) at Target Identifier. */

/* Caution! Major changes exist between these two generics such
   that they may not be compatible.  Check the TOPS and program
   compatibility information for additional information or actions
   needed. */

Execute? (y/n or CANcel/DELete to quit) =
```

See "Install New Generic Program" in the TOP section of this manual for complete instructions before using this command. Use the **`rtrv-map-network`** command to obtain the exact TID for the target system. The current program version may also be obtained from the initial screen when logged into the system with a craft interface terminal (CIT).

When the user gives a positive response to the confirmation message, the program copy begins and the following message is displayed:

```
In progress ..........................................
```

The number of dots and how fast they are displayed depend on the size of the program to be copied, number of DCC spans between the local and remote systems, and DCC traffic.

If the program copy fails, the following failure message will be displayed:

```
SSTP
/* Status, execution SToPped */
/* Program copy failed to Target Identifier
   Before attempting another copy, check the User's Manual
   to review a list of possible problems and their solutions. */
```

When the program has successfully been copied to the remote system, the following message is displayed:

```
/* Generic program m.m.m is copied. */
```

If this command experiences memory space problems at the target network element (that is, the software will not fit in the space allocated in flash memory reserved for it), the currently executing software generic will be overwritten.

RELATED COMMANDS

rtrv-map-network

rtrv-ne

ins-prog

NAME

dlt-crs-sts1: Delete Cross-Connection STS-1

INPUT FORMAT

dlt-crs-sts1:*Address1*,*Address2*[:*cct*=CrsType];

DESCRIPTION

CAUTION:
Execution of this command may affect service.

This command deletes STS-1 cross-connections.

This command is available with all OC-12 ring releases.

The input parameters are:

Address1 and *Address2* These are the addresses of the two STS-1 channels, or one STS-1 channel and one DS3/EC-1/OC-3 port where the existing STS-1 cross-connection is to be deleted. In ring applications, pass-through connections are deleted by using the same address for *Address1* and *Address2*.
Valid OC-12 STS-1 Addresses:
mb-{1-12}, {a,b,c,d}-{1-3}

cct CrsType specifies the cross-connection type. The valid values are:

- **twoway** Two-way cross-connections apply to terminating, hubbing, add/drop, hairpin, pass-through, 0x1 ring, and 0x1 DS3 configurations. This is the default value.
- **dc** Drop and continue connections support dual ring applications. Drop and continue connections are only allowed if the function unit address is equipped with the 3STS1E, 21-type OLIU or 3DS3 low-speed circuit packs.

NOTE:
The *cct* parameter is an optional parameter if the cross-connection type to be deleted is **twoway**. The *cct* parameter is required for other CrsType values.

Address1, *Address2*, and *CrsType* must match an existing STS-1 cross-connection or execution of the command will complete with the following message:

```
/* The specified STS-1 cross-connection does not exist
   and cannot be deleted. */
```

If an attempt is made to execute this command, when a mix of incompatible OLIU packs exists in Main, the request will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* Both main slots must be equipped with compatible OLIU packs. */
```

Users may not delete an STS-1 pass-through cross-connect through a 24G-U OLIU containing traffic VT1.5 traffic. To remove the pass-through cross-connect, users should first delete the associated VT1.5 or STS-3 cross-connect at the ring drop nodes. Otherwise, the request will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* The specified path must be in the AIS state
   to delete the cross-connect. */
```

After entering this command, the following confirmation message is displayed:

```
/* Caution!  Execution of this command may affect service.
   You have selected the dlt-crs-sts1 command with these parameters:

   Address1 = address
   Address2 = address
   CrsType = value */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

ent-crs-sts1

rtrv-crs-sts1

NAME

dlt-crs-sts3c: Delete Cross-Connection STS-3c

INPUT FORMAT

dlt-crs-sts3c:*Address1*,*Address2*[:*cct*=CrsType];

DESCRIPTION

CAUTION:
Execution of this command may affect service.

This command deletes STS-3c cross-connections. STS-3c signals are identified by the first STS-1 address in the STS-3c signal. The following chart shows the mapping for STS-3c addresses to the internal STS-1 signal structure:

STS-3c Mapping

Interface	Address	Internal STS-1 #s
Main-b	mb-1	1,2,3
	mb-4	4,5,6
	mb-7	7,8,9
	mb-10	10,11,12
FN-A	a-1	1,2,3
FN-B	b-1	1,2,3
FN-C	c-1	1,2,3
FN-D	d-1	1,2,3

This command is available with OC-12 ring releases.

The input parameters are:

Address1 and *Address2*

These are the addresses of the two STS-3c channels that are to be deleted. In OC-12 ring releases, the cross-connect mode is automatically set to manual (**crs=***manual*) and cannot be changed. Valid connections are listed below. Where items appear in braces { }, any one (and only one) of these items may be used to form the address.

mb-{1,4,7,10} to {a,b,c,d}-1

mb-{1,4,7,10} to mb-{1,4,7,10}

For pass through signals, Address1 and Address2 must be the identical time slot.

cct CrsType specifies whether the cross-connection is two-way , drop and continue, or for video applications at CO and RT sites. The valid values are:

twoway Two-way applies to add/drop and pass through cross-connections. This is the default value.

dc Drop and continue connections support dual ring applications.

cov Video cross-connections at CO site.

rtv Video cross-connections at RT sites.

The *cct* parameter is an optional parameter if the cross-connection type to be deleted is **twoway**. The *cct* parameter is required for other CrsType values.

Address1, *Address2*, and *CrsType* must match an existing STS-3c cross-connection, or execution of the command will be denied with the following message:

```
SNVS
/*  Status, Not in Valid State  */
/*  The specified STS-3c cross-connection does not exist. */
```

If an attempt is made to execute this command, when a mix of incompatible OLIU packs exists in main, the request will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* Both main slots must be equipped with compatible OLIU packs. */
```

After entering this command, the following confirmation message is displayed:

```
/* Caution!  Execution of this command may affect service.
   You have selected the dlt-crs-sts3c command with these parameters:

   Address1 = address
   Address2 = address
   CrsType = value */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

ent-crs-sts3c

rtrv-crs-sts3c

NAME

dlt-osacmap: delete OS application context ID map entry

INPUT FORMAT

`dlt-osacmap:vc=`*VCType*,**`snpa=`***SNPA*;

DESCRIPTION

This command deletes data terminal equipment (DTE) calling addresses of operations systems (OS) that are assigned to the switched virtual circuit (SVC) and/or the permanent virtual circuit (PVC) in the X.25 subnetwork application context map. This map lists both the PVCs and the DTE calling addresses for the SVC available in the X.25 channel and maps them to OS application contexts. The DTE entries of both SVC and the PVC can be deleted. The PVC entries can be deleted and replaced by SVC entries, or can be changed using the **`ent-osacmap`** command.

NOTE 1:
If security is enabled on any craft interface terminal (CIT) or data communication channel (DCC) port on a shelf, then this command is available to privileged users only for all CIT or DCC ports on the shelf.

NOTE 2:
While this command is allowed at all network elements in the subnetwork, only the table at the active gateway network element (GNE) node is active.

The input parameters are:

vc VCType is the virtual circuit type X.25 attachment for the OS and may be one of the following values:

PVC permanent virtual circuit (default value)

SVC switched virtual circuit.

snpa SNPA is the X.25 subnetwork point of attachment for the OS. It is either the logical channel number (LCN) corresponding to the PVC or the DTE calling address corresponding to the SVC entries in the table. SNPA is 1 to 15 digits and must match an existing entry in the table.

If the **vc** or **snpa** entered is not known by the NE, the command will be denied with the following message:

```
IDNV
 /* Input, Data Not Valid, invalid data entered. */
 /* The corresponding VCType/SNPA value is not found in OSACMAP. */
```

When this command is entered at an active GNE, the following confirmation message will be displayed:

```
/* Caution! Operations System access is affected by this command.

   Caution!  When executed, this command causes the NE's affected
   VC to be reset. This action will drop all currently active
   logins on the affected VC.

   You have selected the dlt-osacmap command with these parameters:

    VCType = x
    SNPA = x */

Execute? (y/n or CANcel/DELete to quit) =
```

When this command is entered at a network element that is not an active GNE, the following confirmation message will be displayed:

```
/* Caution!  This NE is not an active GNE.  Entries in this table are
   not active.  Only the information at an active GNE is valid.

   You have selected the dlt-osacmap command with these parameters:

    VCType = x
    SNPA = x */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

ent-tl1msgmap

rtrv-tl1msgmap

ent-osacmap

rtrv-osacmap

NAME

dlt-ulsdcc-l4: Delete Upper Layer Section DCC

INPUT FORMAT

dlt-ulsdcc-l4:[**L4ajsys=***AJSystemId*][**L4tdctid=***TDCTID*];

DESCRIPTION

NOTE:
This command page describes the functionality of the **dlt-ulsdcc-l4** command in OC-12 Release 7.0 and all later TARP releases.

This command is used to delete provisionable parameters of Layers 3 through 7 of the open systems interconnection (OSI) 7-layer protocol stack. This stack refers to the OSI reference model which is a logical structure for network operations. This model defines a standard communication protocol between network elements as specified by the International Standards Organization (ISO).

This command is used to delete a row of data in buffers which hold user-settable parameters in Layer 4 of the OSI stack. These buffers are the TARP Manually Adjacent NE buffer and the TARP Data Cache (TDC).

NOTE:
If security is enabled, then this command is available to privileged users only for all CIT or DCC ports on the shelf.

The input parameters are:

L4ajsys This parameter specifies the NSAP System Identifier field of the TARP adjacent NE to be deleted from the TARP Manual Adjacency list of local NE. This is a 6 byte (12 hex digit) field of the TARP adjacent NE. Since the System ID is unique for each NE, the System ID is sufficient to identify a specific Manual Adjacency.

The format of this parameter is **L4ajsys=***AJSystemId*, where *AJSystemId* is the 6 byte (12-digit hex) System ID field of the NSAP address of the Adjacent NE in the list.

This parameter deletes a single Manual Adjacent NE. Multiple Manual Adjacent NEs are deleted using multiple occurrences of the **dlt-ulsdcc-l4** command.

The parameter **L4tdctid** is used to specify an entry in the TARP Data Cache (TDC) to delete.

Specifying this parameter causes the deletion of a single row of data in the TDC. Multiple rows of data are deleted using multiple occurrences of this command.

The TDC stores three parameters for each entry; the NSAP, TID and the address type. The address type is not user provisionable and is set to its default value ('FE' hex) in the TDC. Specifying the TID field of the NSAP is sufficient to identify the complete TDC entry.

L4tdctid This parameter specifies the TID of the Network Element for which the row of data is to be deleted from the TDC.

While entering **L4ajsys**, if an incorrect number of digits is entered for a specific parameter, the following message is issued and the user is reprompted:

```
/* Invalid data entry
   Enter a <num> digit hexadecimal number. */
```

The <num> specifies the number of digits required.

If an invalid *L4TDCTID* value is entered (wrong syntax), the following message is displayed and the user is reprompted:

```
/* Invalid data entry
   Invalid L4TDCTID value entered. */
```

After entering this command, the following confirmation message is displayed:

```
/* Caution!  Network Element access is affected by this command.

   You have selected the dlt-ulsdcc-l4 command with these parameters:

   L4ajsys   = AJSystemId
   L4tdctid  = TDCTID */

Execute?  (y/n or CANcel/DELete to quit) =
```

If an entry in the TDC does not match the Target Identifier (TID) specified in the **L4tdctid**, then no action is taken and the following denial message is displayed:

```
IDNV
/* Input, Data Not Valid */
/* Invalid L4tdctid and/or L4tdcsys value was entered. */
```

RELATED COMMANDS

ent-ulsdcc-l4

ent-ulsdcc-l3

rtrv-ulsdcc-l4

NAME

ent-crs-sts1: Enter Cross-Connection STS-1

INPUT FORMAT

ent-crs-sts1:*Address1*,*Address2*[:*cct*=CrsType][,*ring*=RingId];

DESCRIPTION

This command sets bidirectional STS-1 cross-connections between Main and function unit slots in OC-12 ring applications.

The input parameters are:

Address1 and *Address2*

These are the addresses of the two STS-1 channels or one STS-1 channel and one DS3/EC-1/OC-3 port that are to be cross-connected. For STS-1 ring pass-through traffic, *Address1* and *Address2* must be the same time slot. Valid addresses are listed on the following pages.

NOTE:
All cross-connections are bidirectional.

cct CrsType specifies the cross-connection type. The valid values are:

twoway Twoway cross-connections apply to terminating, hubbing, add/drop, pass-through, hairpin, 0x1 ring, dual locked, and 0x1 DS3 configurations. Twoway is the default value. An OC-3 ring may be connected to an OC-12 ring in any 0x1 ring configuration (dual or single-homed).

dc Drop and continue cross-connections support dual ring interworking applications. Drop and continue connections are only allowed if the function unit address is equipped with the 3STS1E, 21-type OLIU or 3DS3 circuit packs.

If the addresses indicate a pass-through cross-connection, the CrsType is not prompted for but is automatically set to **twoway**. The confirmation message indicates that a CrsType of **twoway** has been selected for the user. If a CrsType other than **twoway** is entered on the command line when the addresses indicate a pass-through cross-connection, the request is rejected.

If the CrsType is not **dc**, the RingId is not requested and is not displayed in confirmation messages. If the CrsType is not **dc**, and RingId is entered, the system will ignore any value entered for RingId.

ring This parameter is available with all ring releases. RingId is the ring identification for drop and continue connections.

For **dc** type connections, it specifies which ring rotation will be continued as well as dropped at this network element. The valid values are:

mb1 Ring **mb1** is defined as the ring that is received on the Main-b-1 OLIU and is transmitted on the Main-b-2 OLIU.

mb2 Ring **mb2** is defined as the ring that is received on the Main-b-2 OLIU and is transmitted on the Main-b-1 OLIU.

In OC-12 ring releases, the cross-connect mode is automatically set to manual (**crs=***manual*) and cannot be changed. Valid manual cross-connections are listed below. Where items appear in braces { }, any one (and only one) of these items may be used to form the address.

Ring Cross-Connect Addresses:

mb-{1-12} to {a,b,c,d}-{1-3}
Allowed when function groups A and/or B and/or C and/or D are equipped with 3DS3 or 3STS1E or OLIU circuit packs.

mb-{1-12} to mb-{1-12}
Allowed to cross-connect pass-through signals. Address1 and Address2 must be the identical time slot.

If this command is invoked using addresses where active cross-connections already exist, the following denial message will be displayed:

```
SACC
/* Status, Already Cross-Connected */
/* Establishing new cross-connections requires that
   existing cross-connections associated with these
   addresses be deleted. */
```

If the cross-connection request includes an invalid circuit pack type, invalid port address, or specifies a cross-connection not supported by the system, the following denial message will be displayed:

```
SNVS
/* Status, Not in Valid State */
/* Invalid cross-connection request. */
```

If the cross-connection request is to an STS1E low-speed interface, the EC-1 port state *cannot* be set to NMON or the following denial message will be displayed:

```
SNVS
/* Status, Not in Valid State */
/* The addressed port is in NMON state. */
```

The following denial message will be displayed if both MAIN-B and/or both TSI slots are not equipped:

```
SNVS
/* Status, Not in Valid State */
/* Both main-b and both tsi slots must be equipped */
```

If this command is issued with (**cct=***dc*) and the low-speed address is for a function unit where the *application* parameter (for the **set-oc3** command) is set to "0x1", the following denial message will be displayed:

```
SNVS
/* Status, Not in Valid State */
/* Drop and continue is not supported for the 0x1 application */
```

If this command is issued while the low-speed address is for a function unit where the *application* parameter (in the **set-oc3** command) is set to ***video***, the following denial message will be displayed:

```
SNVS
/* Status, Not in Valid State */
/* STS-1 cross-connection is not supported with video application */
```

If the addresses indicate a pass-through cross-connection and the CrsType is not **twoway**, the request is denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* Invalid cross-connection request */
```

If an attempt is made to execute this command, when a mix of incompatible OLIU packs exists in Main, the request will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* Both main slots must be equipped with compatible OLIU packs. */
```

After entering this command, the following confirmation message is displayed. The `RingId` parameter is displayed in the confirmation message only if the `CrsType` parameter is set to **dc**.

```
/* Caution!  Network cross-connections are affected by this command.
   You have selected the ent-crs-sts1 command with these parameters:

   Address1 = address
   Address2 = address
   CrsType = value
   RingId = value */

Execute? (y/n or CANcel/DELete to quit) =
```

If this command is issued for a drop and continue type of cross-connection and the low-speed address is for a function unit equipped with a 3DS3 circuit pack, the following caution message will be added to the confirmation message:

```
/* Caution!  Asynchronous DS3 failures, such as LOS or AIS,
   will not be mapped into SONET STS AIS and therefore will
   not result in a path protection switch within the OC-12
   ring network. */

/* Caution!  Network cross-connections are affected by this
   command.  You have selected the ent-crs-sts1 command with
   these parameters:

   Address1 = address
   Address2 = address
   CrsType = value
   RingId = value */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

dlt-crs-sts1

rtrv-crs-sts1

NAME

ent-crs-sts3c: Enter Cross-Connection STS-3c

INPUT FORMAT

ent-crs-sts3c:*Address1*,*Address2*[:*cct*=CrsType][,*ring*=RingId];

DESCRIPTION

This command sets both bidirectional and unidirectional STS-3c cross-connections between main-b slots and function unit slots. and between main-b-1 and main-b-2 OLIU circuit packs. The function unit slots must be equipped with 21G or 21D type OLIU circuit packs.

All cross-connections are done using the BCP3 TSI circuit packs in the TSI slots. BCP3-type TSI circuit packs must be used to establish STS-3c cross-connections.

NOTE:
The STS-3c cross-connection is an optional feature that requires a special license from Lucent Technologies. This feature must first be enabled via the **set-feat** command before the cross-connection request takes place.

The STS-3c signals are identified (addressed) by using the first STS-1 address contained in each STS-3c signal. The following chart shows the mapping of STS-3c addresses to the internal STS-1 structure:

STS-3c Mapping Table

Interface	Address	Internal STS-1 #s
Main-b	mb-1	1,2,3
	mb-4	4,5,6
	mb-7	7,8,9
	mb-10	10,11,12
FN-A	a-1	1,2,3
FN-B	b-1	1,2,3
FN-C	c-1	1,2,3
FN-D	d-1	1,2,3

This command is available with OC-12 ring releases.

The input parameters are:

Address1 and *Address2*
These are the addresses of the two STS-3c channels that are to be cross-connected. In OC-12 ring releases, the cross-connect mode is automatically set to manual (**crs=***manual*) and cannot be changed. Valid manual cross-connections are listed below. Where items appear in braces { }, any one (and only one) of these items may be used to form the address.

mb-{1,4,7,10} to {a,b,c,d}-1
Allowed when function groups A and/or B and/or C and/or D are equipped with OLIU (21G or 21D) circuit packs.

mb-{1,4,7,10} to mb-{1,4,7,10}
Allowed to cross-connect pass through signals. Address1 and Address2 must be the identical time-slot.

cct CrsType specifies whether the cross-connection is two-way , drop and continue, or for video applications at CO and RT sites. The valid values are:

twoway Two-way cross-connections apply to add/drop and pass through cross-connections. This is the default value.

dc Drop and continue cross-connections support dual ring applications.

cov Video cross-connections at CO site. Up to four incoming STS-3c signals from OLIU packs in fn-x-1 and fn-x-2 slots will be locked to ring 1 and ring 2, respectively.

rtv Video cross-connections at RT sites. Up to four STS-3c signals from ring 1 and ring 2 are dropped to fn-x-1 and fn-x-2 slots, respectively, and continued on both rings to the next nodes in the network.

ring RingId is the ring identification for drop and continue connections and specifies which ring rotation will be continued as well as dropped at this network element. The valid values are:

mb1 Ring **mb1** is defined as the ring that is received on the main-b-1 OLIU and is transmitted on the main-b-2 OLIU.

mb2 Ring **mb2** is defined as the ring that is received on the main-b-2 OLIU and is transmitted on the main-b-1 OLIU.

If the CrsType is not **dc**, the RingId is not requested and is not displayed in confirmation messages. If the CrsType is not **dc**, and RingId is entered, the system will ignore any value entered for RingId.

If this command is invoked using addresses where active STS-3c cross-connections or active STS-1 cross-connections within the STS-3c address already exist, the following denial message will be displayed:

```
SACC
/* Status, Already Cross-Connected */
/* Establishing new cross-connections requires that
   existing cross-connections associated with these
   addresses be deleted. */
```

If the cross-connection request includes an invalid circuit pack type, invalid address, or specifies a cross-connection not supported by the system, the following denial message will be displayed:

```
SNVS
/* Status, Not in Valid State */
/* Invalid cross-connection request. */
```

The following denial message will be displayed if both Main-B and/or both TSI slots are not equipped:

```
SNVS
/* Status, Not in Valid State */
/* Both main-b and both tsi slots must be equipped */
```

The following denial message will be displayed if the cross-connection request is made before enabling the STS-3c feature through the **set-feat** command:

```
SNVS
/* Status, Not in Valid State */
/* Optional STS-3c feature is disabled. To enable, use set-feat. */
```

The following denial message will be displayed if the cross-connection request is made with **cov** or **rtv** options in the *cct* parameter and when the application parameter in the **set-oc3** command is *NOT* set to **video** option:

```
SNVS
/* Status, Not in Valid State */
/* The specified function unit is not a video application. */
```

If an attempt is made to execute this command, when a mix of incompatible OLIU packs exists in main, the request will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* Both main slots must be equipped with compatible OLIU packs. */
```

After entering this command, the following confirmation message is displayed. The `RingId` parameter is displayed in the confirmation message only if the `CrsType` parameter is set to **dc**.

```
/* Caution!   Network cross-connections are affected by this command.
   You have selected the ent-crs-sts3c command with these parameters:

   Address1 = address
   Address2 = address
   CrsType = value
   RingId = value */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

set-feat

rtrv-feat

set-oc3

rtrv-oc3

dlt-crs-sts3c

rtrv-crs-sts3c

rtrv-crs-sts1

NAME

ent-osacmap: enter OS application context ID map

INPUT FORMAT

ent-osacmap:vc=*VCType*,**snpa=***SNPA*,**acid=***ACID*;

DESCRIPTION

This command creates entries in the X.25 subnetwork application context map. This map lists the permanent virtual circuits (PVCs) and switched virtual circuit (SVC) available in the X.25 channel and maps them to operation systems (OS) application contexts. For the SVC, this command lists the data terminal equipment (DTE) calling addresses used by the various OS application contexts. Defaults for the PVCs are provided, which should apply to most situations.

NOTE 1:
If security is enabled on any CIT or DCC port on a shelf, then this command is available to privileged users only for all CIT or DCC ports on the shelf.

NOTE 2:
While this command is allowed at all network elements in the subnetwork, only the table at the active GNE node is active.

The input parameters are:

vc This parameter is the virtual circuit type X.25 attachment for the OS.

- *PVC* permanent virtual circuit (default value).
- *SVC* switched virtual circuit.

snpa SNPA is the X.25 subnetwork point of attachment address for the OS. It is either logical channel number (LCN) 1, 2, 3, 4, 5, 6, 7, 8, or 9 if VCType is *PVC* or it is the Data Terminal Equipment (DTE) calling address, which is 1 to 15 digits if VCType is *SVC*. Up to nine VCs can be mapped to any combination of PVCs and SVCs (that is, PVCs could be removed and replaced by SVCs).

acid ACID is a string of up to 23 alphanumeric characters, which is the application context ID to be assigned to a particular SNPA address. Each OS has a value of ACID assigned. Default values exist for OS applications supported by DDM-2000. Supported values are:

tl1PeerComm
(Assigned to PVC "1" as default value)

tl1Maintenance
(Assigned to PVC "2" as default value)

tl1MemoryAdministration
(Assigned to PVC "3" as default value)

NOTE:
The values *tl1CR*, *tl1Other1*, *tl1Test*, and *tl1Other2* are provided as additional ACID values for the OS application that are supported by DDM-2000.

Note that *tl1CR* will never report TL1 autonomous messages.

If a user attempts to enter an additional SNPA (LCN/DTE calling address), when the maximum supported number already exists, the following denial message will appear:

```
SLEM
/* Status, List Exceeds Maximum */
/* Maximum number of SNPA entries (LCN/DTE address)
   already exists. */
```

When this command is entered at an active GNE, the following confirmation message will be displayed:

```
/* Caution! Operations System access is affected by this command.

   Caution!  When executed, this command causes the NE's affected
   VC to be reset.  This action will also drop all currently
   active logins on the affected VC.

   You have selected the ent-osacmap command with these parameters:

    VCType = x
    SNPA = x
    ACID = x */

Execute? (y/n or CANcel/DELete to quit) =
```

When this command is entered at a network element that is not an active GNE, the following confirmation message will be displayed:

```
/* Caution!  This NE is not an active GNE.  Entries in this table are
   not active.  Only the information at an active GNE is valid.

   You have selected the ent-osacmap command with these parameters:

    VCType = x
    SNPA = x
    ACID = x */

Execute? (y/n or CANcel/DELete to quit) =
```

NOTE:
The same ACID can appear more than once in the table.

RELATED COMMANDS

ent-tl1msgmap

rtrv-tl1msgmap

dlt-osacmap

rtrv-osacmap

NAME

ent-tl1msgmap: Enter Tl1 Message Map for Operation Systems

INPUT FORMAT

ent-tl1msgmap:acid=*ACID*,**msgtype=***MessageType*,**action=***Action*;

DESCRIPTION

NOTE:
If security is enabled on any CIT or DCC port on a shelf, then this command is available to privileged users only for all CIT or DCC ports on the shelf.

This command maps the DDM-2000 TL1 message types to the operations systems (OS) for this network element in the subnetwork. This command provides a filter for TL1 messages by specifying TL1 message classes (known as *MessageTypes*) and allowing the user to determine which message classes should be received at each type of OS (specified in the *ACID* parameter).

There are default message classes that exist for the ACIDs supported by DDM-2000. The following table shows the default mappings supported by DDM-2000. Most users should be able to use these mappings as defined. However, users may change the default mapping by using this command. Users may check the current provisioning by using the **rtrv-tl1msgmap** command.

The following table displays the default mappings:

```
/* DDM-2000 TL1 Autonomous Message Map
=====================================================
    ACID                  ALM ENV CON DB  EVT PM  SW
=====================================================
tl1Maintenance           | x | x | x |   | x | x | x |
tl1MemoryAdministration  |   |   |   | x |   |   |   |
tl1Test                  |   |   |   |   |   |   |   |
tl1PeerComm              |   |   |   |   |   |   |   |
tl1Other1                | x | x | x | x | x |   | x |
tl1Other2                |   |   |   |   |   |   |   |

      x - enabled
<blank> - disabled
*/
```

Each message type can be assigned to more than one ACID. However, if more than one assignment is made, a 9600 or higher baud x.25 link is recommended.

The input parameters are:

ACID Application Context ID (ACID) is a string of up to 23 alphanumeric characters, which is the OS function. The valid ACID values are:

tl1Maintenance
(This identifies the *maintenance* OS type).

tl1MemoryAdministration
(This identifies the *memory~administration* OS type).

tl1Test (This identifies the *testing* OS type).

tl1PeerComm
(This identifies the OS type for peer TL1 communications. This ACID is also used for incoming X.25 SVC DTE calling addresses that do not match any of the user-provisioned X.25 SVC DTE calling addresses).

tl1Other1
(This identifies the *RIDES* OS type).

tl1Other2
(This identifies an OS type for future use).

msgtype MessageType is one of the supported classes of TL1 messages that the system generates. These message types are *not* sent to the OS unless they are enabled and associated with an ACID. The supported message types are:

ALM To report the occurrence of an event that requires immediate attention by the craft at the OS. Report is sent via the REPT ALM message.

ENV To report the occurrence of an environmental alarm to the OS. Report is sent via the REPT ALM ENV message.

CON To report the active status conditions at the network element. Report is sent via the REPT COND message.

DB To report database changes that have occurred as a result of line termination and cross-connection provisioning commands and changes due to external events such as circuit pack insertion or removal. Report is sent via the REPT DBCHG message.

EVT To report events that do not require alarmed notifications or to report a status change of the network element. Report is sent via the REPT EVT message.

PM To report performance monitoring data from the network element. Report is sent via the REPT PM message.

SW To report equipment protection switches at the network element. Report is sent via the REPT SW message.

`action` Action is either **`enabled`** or **`disabled`** and associates the MessageType to the OS.

When this command is entered, the following confirmation message will be displayed:

```
/* Caution!  Operations Systems Autonomous message mapping is
   affected by this command.

   You have selected the ent-tl1msgmap command with these parameters:

    ACID = x
    MessageType = x
    Action = x           */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

rtrv-tl1msgmap

NAME

ent-ulsdcc-l3: Enter Upper Layer Section DCC - Layer 3

INPUT FORMAT

ent-ulsdcc-l3:[**L3org=***OrganizationId*][,**L3res=***Reserved*][,**L3rd=***RoutingDomain*] [,**L3rarea=***RoutingArea*] [,**L3lv2is=***Level2Router*];

DESCRIPTION

NOTE:
This command page describes the functionality of the **ent-ulsdcc-l3** command in OC-12 Release 7.0 and all later TARP releases.

CAUTION:
Errors in provisioning this command to change the NSAP address of the target Network Element (NE) could result in silent failures. Command parameters should *only* be changed by users who intend and are authorized to provision the SONET subnetwork and partition DCC communications.

This command provisions parameters of Layers 3 of the open systems interconnection (OSI) 7-layer protocol stack. This stack refers to the OSI reference model which is a logical structure for network operations. This model defines a standard communication protocol between network elements as specified by the International Standards Organization (ISO).

If this command is used to change the value of at least one of the fields of Layer 3 NSAP address, it will cause the NE to reset. this action will erase all of the performance monitoring data and the history file. If possible, the NE will reinitialize the date and time. Otherwise, the date and time will assume default values.

This command is used to provision the user-settable fields in Layers 3 of the OSI stack. Layer 3 parameters include user-settable fields of the network service access point (NSAP) address and the enabling of the Level-2 Routing. The NSAP address is a 20-byte (40 hex digit) address required by OSI to provide unique identification within the OSI network. Some of the fields within the NSAP are pre-defined and some others are user-settable. Each DDM-2000 is programmed with a unique NSAP address at the factory.

All Layer 3 parameters that can be provisioned using this command, and that are needed for the operation of the NE, have original values. Hence, it is not necessary to provision these parameters for the NE to operate properly in a network.

NOTE:
If security is enabled, then this command is available to privileged users only for all CIT or DCC ports on the shelf.

The structure of the NSAP is shown in the following display. The field names are shown on the first row, and the size (in bytes) of each field is listed on the second row.

NSAP Structure

NSAP Field:	AFI	IDI	IDI PAD	DFI	Organization ID	RES	RD	Area	System Identifier	SEL
Bytes:	1	2		1	3	2	2	2	6	1
Default Value: (hex)	39	840	F	80	000000	0000	0000	0000	none	00
	not provisionable				user provisionable				not provisionable	

The AFI, IDI and DFI (DSP Format Identifier) fields are not user provisionable. They are always set to "39" hex, "840" hex, "F" hex and "80" hex respectively to indicate that the ISO DCC syntax shall be used.

The Organization ID, Reserved (RES), Routing Domain (RD) and Area fields are user provisionable when setting the NSAP of the target NE.

The Organization ID field is a three byte field that identifies the Network Service Provider and is assigned by the ANSI. The Reserved field is currently not used and has a default value of hex "0000". The Routing Domain and Area fields, each of which are 2 bytes (4 hex digits), area is used in applications where there are multiple Level-1 areas to identify the different areas.

Each NE is programmed with a unique System Identifier at the factory. This six byte (12 hex digit) field of the NSAP guarantees that the NSAP for each NE is unique.

The Select (SEL) field is currently not user provisionable and is normally set to a default value of "0". Its purpose is to differentiate between multiple NSAP addresses associated with the same End system. Its value is not fixed but is set in a PDU according to its usage. It is set to "af" hex when TARP is run over CLNP. It has a value of "1d" hex when TP4 is run over CLNP. it may be set to "00" hex for other uses. When retrieved and displayed, it will always be shown as "00" hex.

For additional information on provisioning, refer to 824-102-144, *2000 Product Family Multi-Vendor Operation Interworking Guide*.

The input parameters are:

L3org Organization Id is a 6-digit hexadecimal field used to provision into the NSAP address the allocated company code assigned by the *ANSI**-administered USA Registration Authority for OSI Organization Names. The original value for this parameter is 000000.

L3res Reserved is a 4-digit hexadecimal field that currently has not been assigned a specific purpose by the SONET standards. Users may populate this field to further uniquely identify the NSAP address. The original value for this parameter is 0000.

L3rd This field identifies a unique routing domain within an administrative domain.

The format of this parameter is **L3rd=***RoutingDomain*, where *RoutingDomain* is the 2 byte (4-digit hex) NSAP Routing Domain field of the local NE. The original value for this parameter is 0000.

L3area This field identifies the area within the routing domain to which the NSAP address belongs.

The format of this parameter is **L3area=***RoutingArea*, where *RoutingArea* is the 2 byte (4-digit hex) NSAP Area field of the local NE. The original value for this parameter is 0000.

L3lv2is Enable or Disable the level 2 IS-IS routing. This parameter is used to specify that the local NE is a Level 2 IS (router).

Possible values of this parameter are: **enable** or **disable**. The default value is **disable**.

If an incorrect number of digits is entered for a specific NSAP parameter, the following message is issued and the user is reprompted:

```
/* Invalid data entry
   Enter a <num> digit hexadecimal number */
```

The <num> specifies the number of digits required.

* Registered trademark of the American National Standards Institute, Inc.

After entering this command the following confirmation message is displayed:

```
/* Caution!  Network Element access is affected by this command.

   Caution! When executed, this command will cause the NE to
   restart the program.  This action will erase all of the
   performance monitoring data and the history file.  If possible,
   it will reinitialize the date and time with the far end via the DCC.
   Otherwise, the date and time will assume default values.

   You have selected the ent-ulsdcc-l3 command with these parameters:

   L3org     = OrganizationId
   L3res     = Reserved
   L3rd      = RoutingDomain
   L3area    = RoutingArea
   L3lv2is   = Level2Router

Execute?  (y/n or CANcel/DELete to quit) =
```

NOTE:
This command executes immediately upon entering it; however the changes may not be refected in the **`rtrv-map-neighbor`** report for up to 20 minutes after this command is executed.

If the user enters the same parameter values as currently defined for the "L3" parameters, the system does not reset.

RELATED COMMANDS

dlt-ulsdcc-l4

ent-ulsdcc-l4

rtrv-ulsdcc-l3

rtrv-ulsdcc-l4

NAME

ent-ulsdcc-l4: Enter Upper Layer Section DCC - Layer 4

INPUT FORMAT

ent-ulsdcc-l4:[**L4tlif=***LifeTime*][[[,**L4ajsys=***AJSystemId*]
[[,**L4ajorg=***AJOrganizationId*] [,**L4ajres=***AJReserved*]
[,**L4ajrd=***AJRoutingDomain*][,**L4ajarea=***AJRoutingArea*]]]]
[[,**L4t1tm=***TimerT1*][,**L4t2tm=***TimerT2*] [,**L4t3tm=***TimerT3*]
[,**L4t4tm=***TimerT4*][,**L4lftm=***LDBFlushTimer*]]
[[,**L4etdc=***L4etdc*][[,**L4tdcsys=***L4tdcSystemId*][[,**L4tdctid=***L4tdctid*]
[,**L4tdcorg=***L4tdcOrganizationId*][,**L4tdcres=***L4tdcReserved*]
[,**L4tdcrd=***L4tdcRoutingDomain*][,**L4tdcarea=***L4tdcRoutingArea*]]]];

DESCRIPTION

NOTE:
This command page describes the functionality of the **ent-ulsdcc-l4** command in OC-12 Release 7.0 and all later TARP releases.

CAUTION:
Errors in provisioning this command to change the NSAP address of the target Network Element (NE) could result in silent failures. Command parameters should *only* be changed by users who intend and are authorized to provision the SONET subnetwork and partition DCC communications.

This command provisions parameters of Layers 4 of the open systems interconnection (OSI) 7-layer protocol stack. This stack refers to the OSI reference model which is a logical structure for network operations. This model defines a standard communication protocol between network elements as specified by the International Standards Organization (ISO).

This command is used to provision the user-settable fields in Layer 4 of the OSI stack. The NSAP address is a 20-byte address required by OSI to provide unique identification within the OSI network. Some of the fields within the NSAP are pre-defined and some others are user-settable. Each DDM-2000 is programmed with a unique NSAP address at the factory.

User-settable Layer 4 parameters are used to enter TARP Manual Adjacencies. Manually specifying a NE to be logically adjacent to local NE, for TARP propagation purposes requires the specification of the adjacent NEs NSAP address. The NSAP, which is 20 bytes long (40 hex digit), is composed of separate fields, most of which have default values. Thus, to simplify the entry of the NSAP address, the NSAP is entered via a number of separate TARP Manual Adjacency NSAP parameters; those parameters are covered in a later section of

this command page.

Multiple TARP Manual Adjacent NE values are entered using multiple occurrences of this command.

All Layer 4 parameters that can be provisioned using this command, and that are needed for the operation of the NE, have original values. Hence, it is not necessary to provision these parameters for the NE to operate properly in a network.

NOTE 1:
A maximum of two Manual Adjacencies can be initiated from a Network Element.

NOTE 2:
If security is enabled, then this command is available to privileged users only for all CIT or DCC ports on the shelf.

The structure of the NSAP is shown in the following display. The field names are shown on the first row, and the size (in bytes) of each field is listed on the second row.

NSAP Structure

NSAP Field:	AFI	IDI	IDI PAD	DFI	Organization ID	RES	RD	Area	System Identifier	SEL
Bytes:	1	2		1	3	2	2	2	6	1
Default Value: (hex)	39	840	F	80	000000	0000	0000	0000	none	00
	not provisionable				user provisionable				not provisionable	

The AFI, IDI and DSI (DSP Format Identifier) fields are not user provisionable. They are always set to "39" hex, "840" hex, "F" hex and "80" hex respectively to indicate that the ISO DCC syntax shall be used.

The Organization ID, Reserved (RES), Routing Domain (RD) and Area fields are user provisionable when entering a TARP Manual Adjacency NSAP and when entering an NSAP into the TARP Data Cache (TDC).

The Organization ID field is a three byte field that identifies the Network Service Provider and is assigned by the ANSI. The Reserved field is currently not used and has a default value of hex "0000". The Routing Domain and Area fields, each of which are 2 bytes (4 hex digits), area used in applications where there are multiple Level-1 areas to identify the different areas.

Each NE is programmed with a unique System Identifier at the factory. This six byte (12 hex digit) field of the NSAP guarantees that the NSAP for each NE is unique.

The Select (SEL) field is currently not user provisionable and is normally set to a default value of "0". Its purpose is to differentiate between multiple NSAP addresses associated with the same End system. Its value is not fixed but is set in a PDU according to its usage. It is set to "af" hex when TARP is run over CLNP. It has a value of "1d" hex when TP4 is run over CLNP. It may be set to "00" hex for other uses. When retrieved and displayed, it will always be shown as "00" hex.

For additional information on provisioning, refer to 824-102-144 *2000 Product Family Multi-Vendor Operation Interworking Guide*.

The user-settable input parameters are:

`L4tlif` This parameter sets the TARP lifetime parameter in TARP PDUs originated by the local NE. The TARP lifetime specifies the maximum number of hops allowed for a TARP PDU. When this number of hops is exceeded, the TARP PDU will not be forwarded. This parameter may have a value in the range from 1 to 65535. An error message will be returned if a value of 0 is entered. The default value for this parameter is 100 in decimal.

`L4ajsys` This parameter is used to provision the NSAP System Identifier field of the TARP adjacent NE. This is a 6 byte (12 hex digit) field of the TARP adjacent NE. No default value is assumed for this parameter.

NOTE:
The NSAP System Id field, **`L4ajsys`**, which is unique for each NE, is the only parameter that is required to enter a manual adjacency.

If this parameter is specified, then any of the other user settable NSAP field parameters that are not specified and NSAP fields that are not settable by the user (IDP, DFI and SEL fields) are set to their default values in the TARP Manual Adjacency list. These default values shall be the equivalent NSAP fields of the local NE. If no value is specified for **`L4ajsys`** parameter, the user will not be prompted for the rest of the **`L4aj`** parameters.

`L4ajorg` This parameter is used to provision the NSAP Organization Id field of the TARP adjacent NE. This is a 3 byte (6-digit hex) field of the TARP adjacent NE. The default value for this parameter is the value of the NSAP Organization Id field of the local NE.

`L4ajres` This parameter is used to provision the NSAP Reserved field of the TARP adjacent NE. This is a 2 byte (4-digit hex) field of the TARP adjacent NE. The default value for this parameter is the value of the

NSAP Reserved field of the local NE.

L4ajrd This parameter is used to provision the NSAP Routing Domain field of the TARP adjacent NE. This is a 2 byte (4-digit hex) field of the TARP adjacent NE. The default value for this parameter is the value of the NSAP Routing Domain field of the local NE.

L4ajarea This parameter is used to provision the NSAP Area field of the TARP adjacent NE. This is a 2 byte (4-digit hex) field of the TARP adjacent NE. The default value for this parameter is the value of the NSAP Area field of the local NE.

L4t1tm This parameter is used to provision the TARP Timer T1. T1 is the maximum time waiting for response to TARP Type 1 request PDU (search level 1 routing area). This parameter may have a value in the range from 1 to 3600 seconds. Its default value is 15 seconds.

L4t2tm This parameter is used to provision the TARP Timer T2. T2 is the maximum time waiting for response to TARP Type 2 request PDU (search outside of level 1 area). This parameter may have a value in the range from 1 to 3600 seconds. Its default value is 25 seconds.

L4t3tm This parameter is used to provision the TARP Timer T3. T3 is the maximum time waiting for response to Address resolution request (type 5, for example, requesting the TID when the NSAP address is known). This parameter may have a value in the range from 1 to 3600 seconds. Its default value is 40 seconds.

L4t4tm This parameter is used to provision the TARP Timer T4. T4 starts when T2 expires. It is used for error recovery. This parameter may have a value in the range from 1 to 3600 seconds. Its default value is 20 seconds.

L4lftm This parameter is used to provision the TARP Loop Detection Buffer Flush Timer. It sets the time period for flushing the TARP Loop Detection Buffer. This parameter may have a value in the range from 1 to 1440 minutes. Its default value is 5 minutes.

L4etdc This parameter is used to Enable or Disable the TARP Data Cache. Possible values are either **enable** or **disable**. The default value is **enable**.

The following set of parameters are used to enter data manually into the TARP Data Cache. An entry in a TARP Data Cache consists of three parameters: The NSAP address, the Target Identifier (TID) and the address type of an NE. The NSAP, which is 20 bytes long (40 hex digit), is composed of separate fields, most of which have default value. To simplify the entry of the NSAP address, the NSAP is entered via a number of separate TDC NSAP parameters, as follows:

L4tdcsys This parameter is used to provision the NSAP System Identifier field of the NE to be manually entered into the TARP Data Cache. If this parameter is specified, then

L4tdctid must also be specified for the entry to be made in the TARP Data Cache.

This is a 6 byte (12 hex digit) field of the NE to be manually entered into the TARP Data Cache. There is no default value for this parameter.

NOTE:
The NSAP System ID field, **L4tdcsys**, which is unique for each NE, is the only parameter that is required to enter a TARP data cache entry.

If this parameter is specified, then any of the other user settable NSAP field parameters that are not specified and NSAP fields that are not settable by the user (IDP, DFI and SEL fields) are set to their default values in creating the NSAP portion of the TARP Data Cache entry. Those default values will be the equivalent NSAP fields of the local NE.

If no value is specified for **L4tdcsys** parameter, the user will not be prompted for the rest of the **L4tdc** parameters.

L4tdctid This parameter is used to provision the Target Identifier (TID) portion of TARP Data Cache entry for manually entering data into the TARP Data Cache (TDC). It indicates the TID of the NE associated with the TDC NSAP address parameters that are specified. This parameter has a maximum of 20 characters and it has no default value.

If L4tdctid is specified, then L4tdcsys must have also been specified for the entry to be made in TARP Data Cache.

Along with the TDC NSAP, this parameter is required to enter a set of data into the TDC. Both the NSAP parameters and L4tdctid need to be specified for the transaction to be complete. This will enter a single row of data into the TDC. Multiple rows of data are entered using multiple occurrences of **ent-ulsdcc-l4**.

NOTE:
If the set of specified NSAP and TID does not already exist in the TDC, then the data is added to the TDC. If the NSAP-TID pair already exists in the TDC, then no action is taken.

`L4tdcorg` This parameter is used to provision the NSAP's Organization Id field of the NE that is to be manually entered into the TDC. It specifies the allocated Network Services Provider Code assigned by the ANSI-administered USA Registration Authority for OSI Organization Names. The default value for this parameter is the NSAP's Organization ID field of local NE.

`L4tdcres` This parameter is used to provision the NSAP Reserved field of the NE to be manually entered into the TDC. This is a two byte (4-digit hex) NSAP Reserved field of the NE that is to be manually entered into the TDC. The default value for this parameter is the NSAP's Reserved field of local NE.

`L4tdcrd` This parameter is used to provision the NSAP Routing Domain field of the NE to be manually entered into the TDC. This is a 2 byte (4-digit hex) NSAP Routing Domain field of the NE to be manually entered into the TDC. The default value for this parameter is the NSAP's Routing Domain field of local NE.

`L4tdcarea`
This parameter is used to provision the NSAP Area field of the NE to be manually entered into the TDC. It identifies the Area within the Routing Domain to which the NSAP address belongs. This is a 2 byte (4-digit hex) NSAP Area field of the NE to be manually entered into the TDC. The default value for this parameter is the NSAP's Area field of local NE.

If an incorrect number of digits is entered for a specific NSAP parameter, the following message is issued and the user is reprompted:

```
/* Invalid data entry
   Enter a <num> digit hexadecimal number */
```

The `<num>` specifies the number of digits required.

If an invalid *L4tlif* value is entered (that is, a value equal to or less than 0, or a value greater than 65535), the following message is displayed and the user is reprompted:

```
/* Invalid data entry
   Invalid L4tlif value entered. */
```

If an invalid *L4t1tm*, *L4t2tm*, *L4t3tm*, *L4t4tm* or *L4lftm* value is entered (for example, a value equal to or less than 0), the following message is displayed and the user is reprompted:

```
/* Invalid data entry. */
```

If an invalid *L4TDCTID* value, or no *L4TDCTID* value is entered, the following message is displayed and the user is reprompted:

```
/* Invalid data entry
   Invalid L4TDCTID value entered. */
```

After entering this command the following confirmation message is displayed:

```
/* You have selected the ent-ulsdcc-l4 command with these parameters:

   L4tlif    = LifeTime
   L4ajsys   = AJSystemId
   L4ajorg   = AJOrganizationId
   L4ajres   = AJRserved
   L4ajrd    = AJRoutingDomain
   L4ajarea  = AJRoutingArea
   L4t1tm    = TimerT1
   L4t2tm    = TimerT2
   L4t3tm    = TimerT3
   L4t4tm    = TimerT4
   L4lftm    = LDBFlushTimer
   L4etdc    = L4etdc
   L4tdcsys  = L4tdcSystemId
   L4tdctid  = L4tdctid
   L4tdcorg  = L4tdcOrganizationId
   L4tdcres  = L4tdcReserved
   L4tdcrd   = L4tdcRoutingDomain
   L4tdcarea = L4tdcRoutingArea

Execute?  (y/n or CANcel/DELete to quit) =
```

If the user changes the value of any "L4" parameter or enters the same parameter values as currently defined for the "L3" parameters, the system does not reset.

RELATED COMMANDS

ent-ulsdcc-l3

rtrv-ulsdcc-l3

rtr-vulsdcc-l4

dlt-ulsdcc-l4

NAME

help: Provide In-context Help

INPUT FORMAT

?

DESCRIPTION

Help (**?**) provides help within a craft dialog on the CIT. Help is provided automatically when an invalid input is entered and can also be requested at any time by typing "**?**". The "**?**" displays a help message and then displays another prompt.

The help message is either a description of format of the required entry or a menu of choices.

NAME

init-pm: Initialize Performance Monitoring (PM)

INPUT FORMAT

`init-pm:reg=`*`Register`*;

DESCRIPTION

This command initializes all current day and/or all current quarter-hour performance-monitoring storage registers. Registers for previous day and previous quarter-hours are not affected.

NOTE:
If security is enabled on any CIT or DCC port on a shelf, then this command is available to privileged users only for all CIT or DCC ports on the shelf.

The input parameter is:

`reg` Register is the class of registers to be initialized and may be one of the following:

- **`day`** Day registers
- **`qh`** Quarter-hour registers
- **`all`** Day and quarter-hour registers

RELATED COMMANDS

rtrv-pm-line

rtrv-pm-sect

rtrv-pm-sts1

rtrv-pm-tca

NAME

init-sys: Initialize System

INPUT FORMAT

`init-sys`:*`Address`*;

DESCRIPTION

CAUTION:
Execution of this command may affect service. The command **`init-sys:all`** should NOT be used on an in-service system. This command should only be used at the end of installation before system turnup.

This command initializes provisionable parameters to their default values. The time and date parameters are reset from the far end.

NOTE:
After entering the **`init-sys`** command, the system will show transient DCC failures that are recorded in the Alarm and History reports. This is a normal, expected system response.

The command **`init-sys:all`** should be used only at the end of installation before system turnup. The command **`init-sys:sysctl`** should only be used after a SYSCTL is replaced. To clear a system problem, the **`reset`** command should be used, since it resets the system software without changing the provisioned parameters except for the page parameter in **`set-link`**, which is reset to default value in this case.

NOTE:
This command is available to privileged users only.

The input parameter is:

`Address` Address determines whether just system controller parameters are initialized or whether all parameters on the entire system are initialized. Address may have the following values:

`sysctl` The address **`sysctl`** can be used after a system controller is replaced on an in-service system. It is the equivalent of pressing the UPD/INIT button within 10 seconds of the processor start-up sequence (while the CR LED on the user panel is flashing). This command restores the following list of parameters to their default values:

NOTE:
Parameters can be provisioned using the following commands listed below the parameters.

Alarm delays
set-attr-alm

NSAP

Starting with OC-12 Release 7.0 and later TARP releases, the following additional parameters will be affected as well:
L4ajorg, L4ajres, L4ajrd, L4ajarea, L4ajsys
L3lv2is
L4tlif
L4t1tm, L4t2tm, L4t3tm, L4t4tm, L4lftm
L4etdc
ent-ulsdcc-l3
ent-ulsdcc-l4

Security
set-lgn
set-passwd
set-secu

CIT link configuration
set-link

Protection Switching
(inhibit, forced, lockout, manual)
switch-fn
switch-line
switch-ls
switch-sync

Performance monitoring thresholds
set-pmthres-sect
set-pmthres-line
set-pmthres-t3
set-pmthres-sts1

Environmental alarm names and alarm levels
set-attr-env

Environmental control names
set-attr-cont

Far-end communications enabled/disabled
set-fecom

STS-1 Trace Value
set-trace-sts1

Idle value, Alarm Group and AGNE
set-ne

In OC-12 Release 7.0 and later TARP releases, the Alarm Group and AGNE parameter will not be part of the **set-ne** provisioning parameters, and therefore will not be affected by this command.

ACID, VCType, SNPA
ent-osacmap
ent-tl1msgmap

all The address **all** is used only at the end of an installation before turning over the system. This ensures that all parameters in the system have the proper default values before any system-specific provisioning is done.

CAUTION:
The address **all** should NOT be used on an in-service system.

NOTE:
The **init-sys:all** command is available to privileged users only.

This parameter initializes all the parameters listed under **sysctl** PLUS the following:

Loopbacks
opr-lpbk-ec1
opr-lpbk-t3

Cross-connections
dlt-crs-sts1
ent-crs-sts1

OC-12/OC-3 signal degrade thresholds
set-oc12
set-oc3
set-ec1
set-sts1

Signal failure thresholds
set-t3
set-ec1
set-state-ec1
set-state-t3

Protection Switching (manual)
switch-fn
switch-line
switch-sync

Feature Options
set-feat

System name (TID)
set-ne

PMN
set-attr-alm

Site Id, NE Id and Shelf Id — In OC-12 Release 7.0 and later TARP releases, the Site Id and NE Id parameters will not be available, and therefore are not affected by this command.
set-ne

TBOS and CO/RT selection — In OC-12 Release 7.0 and later TARP releases, the TBOS parameter will not be available, and therefore it will not be affected by this command.
set-ne

UserSide/NetworkSide settings on DCC
DCC Channel IAO LAN
set-fecom

In addition to initializing parameters, entering the address **all** will clear all performance monitoring data and alarms. For failure conditions that still exist after parameters are initialized, the alarms will be redeclared. Time and date parameters are not affected by this command.

Executing an **init-sys:sysctl** with no TGS packs equipped will set the following parameters to default values:

Feature Options

Directory Services Network Element (DSNE) — In OC-12 Release 7.0 and later TARP releases, the DSNE parameter will not be part of the **set-ne** provisioning parameters, and therefore will not be affected by this command.

System name (TID)

PMN

Site Id, NE Id and Shelf Id — In OC-12 Release 7.0 and later TARP releases, the Site Id and NE Id parameters will not be part of the **set-ne** provisioning parameters, and therefore will not be affected by this command.

TBOS Address — In OC-12 Release 7.0 and later TARP releases, the TBOS Address parameter will not be part of the **set-ne** provisioning parameters, and therefore will not be affected by this command.

TBOS Enabled — In OC-12 Release 7.0 and later TARP releases, the TBOS Enabled parameter will not be part of the **set-ne** provisioning parameters, and therefore will not be affected by this command.

TBOS link — In OC-12 Release 7.0 and later TARP releases, the TBOS link parameter will not be part of the **set-ne** provisioning parameters, and therefore will not be affected by this command.

CO/RT selection

UserSide/NetworkSide settings on DCC

DCC channel enable/disable

IAO LAN enable/disable

When the command **`init-sys:sysctl`** is entered, the following confirmation message will be displayed:

```
/* CAUTION!
   Execution of this command will set ALL parameters on the
   controller to their original default values.
   This may disrupt this system's operations interfaces.
   Refer to the DDM-2000 User/Service Manual before executing
   this command.

   Caution!  When executed, this command causes the NE to
   restart the program.  This action will erase all of
   the performance monitoring data and the history file,
   and reinitialize the date and time with the far end
   system.

   Proceed with EXTREME CAUTION!

   You have selected the init-sys command with these parameters:

   Address = sysctl */
Execute? (y/n or CANcel/DELete to quit) =
```

NOTE:
Executing **`init-sys:sysctl`** may cause the system to respond with the following message: `Parameters set to default values.` This means that the circuit pack in a specified slot has failed or has been removed, and the parameters for ports associated with that slot have been set to their default values.

Entering the command **`init-sys:all`** will cause the following confirmation message to be displayed:

```
/* CAUTION!

   THIS COMMAND SHOULD NEVER BE EXECUTED ON AN IN-SERVICE SYSTEM!

   This command will set ALL parameters in the whole system
   to their original default values.
   This may result in a lengthy service outage and may disrupt
   this system's operations interfaces.

   Caution!  When executed, this command causes the NE to
   restart the program.  This action will erase all of
   the performance monitoring data and the history file,
   and reinitialize the date and time with the far end
   system.

   PROCEED WITH EXTREME CAUTION!

   You have selected the init-sys command with these parameters:

   Address = all */
Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

reset

upd

NAME

ins-prog: Install Program

INPUT FORMAT

ins-prog:*TID;*

DESCRIPTION

This command installs a new program into the system controller. This command supports a local program installation to a network element from a personal computer (PC) connected to the CIT port of the target system. The command **cpy-prog** is used to copy the system controller program from a local network element to a remote network element.

The software to be installed may be a non-executing dormant copy of a software generic. When executing this command, the local network element will support local or remote program installation into the memory of the target network element where it will reside as a dormant copy.

The **apply** command is used later to overwrite the currently executing generic with a copy of the generic included in the dormant software.

NOTE:
This command cannot be executed during a remote login session.

This command also supports a remote program installation to flash memory as standby copy from a PC connected to the CIT port of another DDM-2000 system.

NOTE 1:
This command must be executed from a PC with the program to be installed in its hard disk or on a set of floppy disks.

NOTE 2:
If security is enabled on any CIT or DCC port on a shelf, then this command is available to privileged users only for all CIT or DCC ports on the shelf. If security is not enabled on *all* shelves in the network, users on unsecured shelves will be able to install software into the dormant memory of shelves with security enabled.

The input parameter is:

TID The Target Identifier (system name) of the shelf into which the program will be loaded. TIDs are case insensitive.

If the command syntax is correct, the following message will be displayed:

```
/* Testing for program installation ... */
```

This command can only be completed successfully if it is executed from a CIT or modem port but not if it is received over the DCC. This command cannot be executed during a remote login session. If this command is executed during a remote login session, the following message will be displayed:

```
SNVS
/* Status, Not in Valid State */
/* This command cannot be executed from within a rlgn session. */
```

If this command is not executed from a PC, the following denial message will be displayed:

```
SSTP
/* Status, execution SToPped */
/* PC communication link could not be established.
   Please connect PC with program to be installed and start again. */
```

If this command is used to install a program for a certain product type while the TID of the shelf into which the program will be loaded identifies a different product type (for example, a program to be installed is for DDM-2000 OC-3 product type, while the target product type is FT-2000), the request will be denied and the following message is displayed:

```
IITA
/* Input, Invalid TArget identifier (TID) */
/* <TID> is a different product type;
   Incompatible software. */
```

If this command is used to install a program locally to a DDM-2000 but the PC contains DLC Subsystem program, the following denial message will be displayed:

```
SSTP
/* Status, execution SToPped */
/* Incompatible program. */
```

If the communication link between the PC and the system that it connects to fails, the following denial message will be displayed:

```
SSTP
/* Status, execution SToPped */
/* PC communication link failure. */
```

To support remote program installation from a PC, the PC, the local system that the PC connects to, and the target system must be running compatible programs. To support local program installation from a PC, the PC, and the local (target) system that the PC connects to must be running compatible programs. If the programs are not compatible, the following denial message will be displayed:

```
SSTP
/* Status, execution SToPped */
/* Communication protocol failure. */
```

For remote program installation, if the target system has a communication failure, has a "P" displayed in its SYSCTL 7-segment LED display, or does not support remote program installation from a PC, the following denial message will be displayed:

```
SSTP
/* Status, execution SToPped */
/* Communication failure. */
```

If a Network Element (NE) receives this command, but is unable to determine a TID-NSAP translation for the entered TID (TID could not be found), this command will be denied and the following message displayed:

```
SNVS
/*Status, Not in Valid State */
/* Remote session cannot be established.
   TID entered is not found. */
```

If the entered TID does not match the remote NE's TID (only the NSAP matched in this case), this command will be denied and the following message displayed:

```
SNVS
/*Status, Not in Valid State */
/* Remote session cannot be established.
   Inconsistent TID.
   NSAP=<XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX> */
```

In the above message, NSAP represents the remote NE's NSAP.

If an NE receives this command and is able to determine a TID-NSAP translation, but the NSAP is unreachable (TID is kept the same, but NSAP must have been changed), this command will be denied and the following message displayed:

```
SNVS
/*Status, Not in Valid State */
/* Remote session cannot be established.
   Association setup failure.
   NSAP=<XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX> */
```

In the above message, NSAP represents the one found in the TID-NSAP translation.

If communication cannot be established when attempting to download software to a local site from a PC, the following message will be displayed:

```
SSTP
/* Status, execution SToPped */
/* Communication link cannot be established.
   Please connect PC with DDM-2000 upgrade
   program and start again. */
```

If a user attempts to download software that is incompatible with the shelf type (for example, DDM-2000 OC-12 software into a DDM-2000 OC-3 system), or controller type for OC-12 shelves equipped with BBG8/BCP4 controllers, the following denial message will be displayed:

```
SCSN
/* Status, invalid Command SequenCe */
/* Incompatible Software */
```

When upgrading software, the following confirmation message will be displayed after testing for program installation:

```
/* Caution! Execution of this command will overwrite the current
   dormant generic (if any) at Target Identifier. */

Execute? (y/n or CANcel/DELete to quit) =
```

When this command is used to download a new release of software (into the dormant memory of remote system) that is significantly different from software currently running on the remote system, or to download software into the dormant memory of a local system from a PC where the software to be downloaded is significantly different from software currently running on the local system, the following confirmation message is displayed:

```
/* Caution! Execution of this command will overwrite the current
   dormant generic (if any) at Target Identifier. */

/* Caution! Major changes exist between these two generics such
   that they may not be compatible.  Check the TOPS and software
   compatibility information for additional information or actions
   needed. */

Execute? (y/n or CANcel/DELete to quit) =
```

When a user gives a positive response to the confirmation message, the following message is displayed:

```
In progress ..........................................
```

The number of dots and how fast they are displayed depend on the size of the program to be installed, baud rate, and for remote program installation, number of DCC spans between the local and remote systems, and DCC traffic.

See "Install New Generic Program" in the TOP section of this manual for complete instructions before using this command. Use the **rtrv-ne** or **rtrv-map-network** commands to obtain the exact TID for the system. The command **rtrv-eqpt** provides the current program version. The current program version may also be obtained from the initial screen and every report header line when logged into the system with a craft interface terminal (CIT). The current program version is also available on the user panel.

Each time a carriage return is entered, the system will also print a header line containing the TID and program version.

RELATED COMMANDS

rtrv-eqpt

rtrv-ne

NAME

logout: Terminate CIT Session

INPUT FORMAT

`logout`;

DESCRIPTION

This command terminates a user CIT session.

If this command is entered during a local session, it will terminate all sessions established by the user. If entered during a remote session, this command will terminate the remote session and return the user to the local session.

RELATED COMMANDS

rlgn

toggle

NAME

opr-aco: Operate Alarm Cutoff

INPUT FORMAT

`opr-aco;`

DESCRIPTION

This command silences the audible office alarms. Alarms remain silent until a new alarm condition arises.

If this command is executed while there is an active alarm condition in the system, it will:

- Silence active audible office alarms
- Light the alarm cut-off (ACO) LED on the user panel
- Set the parallel telemetry ACO output point
- Clear all parallel telemetry outputs except the system ID and ACO outputs.

This command is equivalent to pushing the ACO button on the user panel, activating the TBOS ACO control point, or activating the parallel telemetry ACO input.

For any DDM-2000 Multiplexer shelf in a network that has co-located DDM-2000 shelves (same *`site`* parameter settings), any one of the following actions will silence audible office alarms on all shelves at the same site:

- Pressing the ACO button
- Executing the OPR-ACO command
- Activating the parallel telemetry ACO input
- Setting the TBOS ACO control point.

NAME

opr-lpbk-ec1: Operate-Loopback-EC1

INPUT FORMAT

opr-lpbk-ec1:*Address*[:**lpbktype=***LoopbackType*];

DESCRIPTION

CAUTION:
Execution of this command may affect service.

This command executes a loopback on a low-speed STS1E interface towards the optical fiber (terminal) or DSX (facility), as shown in Figure 11-1.

Both the terminal and facility loopback can be set at the same time. The loopback remains in place until it is released by the **rls-lpbk-ec1** command.

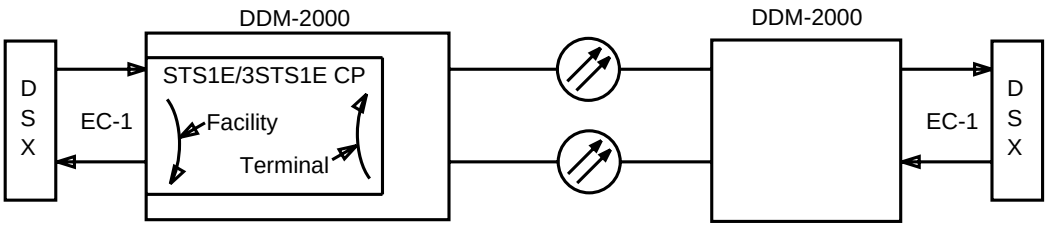


Figure 11-1. EC1 Loopback

The input parameters are:

Address Address of EC-1 port(s) to be looped back.
Valid EC-1 Port Addresses: **{a,b,c,d}-{1-3,all}**

lpbktype loopbacktype specifies whether the loopback is terminal or facility

- *terminal* terminal loopback directed towards the high-speed facility. This is a default value.
- *facility* facility loopback directed towards the DSX.

If a slot is determined to have the wrong circuit pack type for the command, the following message is displayed:

```
/* Address not equipped for STS1E */
/* Enter low-speed EC-1 port address: {a,b,c,d,all} */
```

If the command cannot be completed due to hardware problems on the SYSCTL, the following message is displayed:

```
/* SYSCTL failed - no loopback established */
```

When input, this command will cause the following confirmation message to be displayed:

```
/* Caution! Execution of this command may affect service.
   You have selected the opr-lpbk-ec1 command with these parameters:

   Loopbacktype=loopbacktype
   Address=address */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

rls-lpbk-ec1

NAME

opr-lpbk-t3: Operate-Loopback-T3

INPUT FORMAT

opr-lpbk-t3:*Address*[:**lpbktype=***LoopbackType*];

DESCRIPTION

CAUTION:
Execution of this command may affect service.

This command executes a loopback on a DS3 port towards the optical fiber (terminal) or DSX (facility), as shown in Figure 11-2.

The terminal and facility loopbacks cannot be set at the same time. The loopback remains in place until released by the **rls-lpbk-t3** command.

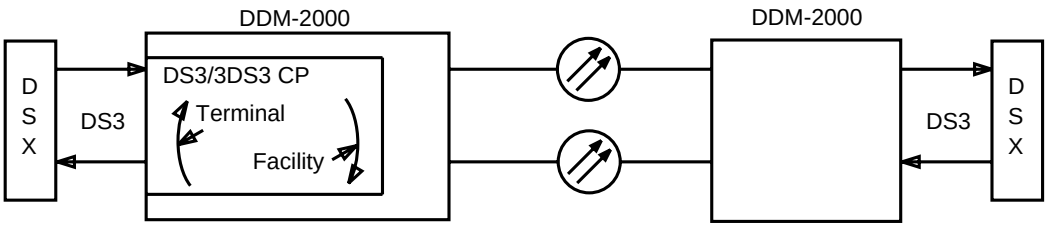


Figure 11-2. DS3 Loopback

The input parameters are:

Address Address of DS3 port(s) to be looped back.
Valid DS3 Port Addresses: **{a,b,c,d}-{1-3,all}**

lpbktype loopbacktype specifies whether the loopback is terminal or facility

- *terminal* terminal loopback directed towards the high-speed facility. This is a default value.
- *facility* facility loopback directed towards the DSX.

If the loopback type is not consistent with the address, the following denial message is displayed:

```
SNVS
   /* Status, Not in Valid State */
   /* loopback type is not consistent with the address. */
```

If the command cannot be completed due to hardware problems on the circuit pack, the following message is displayed:

```
/* Address CPname CP failed */
```

Address and *CPname* refer to the slot address and provisioned circuit pack type for the slot, respectively.

If a slot is in AUTO state or determined to have the wrong circuit pack type for the command, the following message is displayed:

```
/* Slot is in AUTO state or Address is not equipped  - no
   loopback established */
/* Enter DS3 port Address:   */
```

If the command cannot be completed due to hardware problems on the SYSCTL, the following message is displayed:

```
/* SYSCTL failed - no loopback established */
```

If this command is invoked to establish other than an existing loopback type (that is, if a facility loopback is requested when a terminal loopback already exists or vice versa) for the same address, the following denial message will be displayed:

```
SNVS
   /* Status, Not in Valid State */
   /* Establishing new loopback type (facility/terminal) requires that
      existing loopback type (terminal/facility) associated with this
      address must be released. */
```

When input for terminal loopback, this command will cause the following confirmation message to be displayed:

```
/* Caution! Execution of this command may affect the DS3
   performance monitoring data and may affect service.
   You have selected the opr-lpbk-t3 command with these parameters:

   Loopbacktype=loopbacktype
   Address=address */

Execute? (y/n or CANcel/DELete to quit) =
```

When input for facility loopback, this command will cause the following confirmation message to be displayed:

```
/* Caution! Execution of this command may affect the DS3
   performance monitoring data and may affect service.
   You have selected the opr-lpbk-t3 command with these parameters:

   Loopbacktype=loopbacktype
   Address=address */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

rls-lpbk-t3

NAME

reset: Reset the System Software Program

INPUT FORMAT

`reset`;

DESCRIPTION

CAUTION:
Execution of this command may affect performance-monitoring data.

This command resets the system software program. All history and performance-monitoring data is lost. All alarm information is lost and "rediscovered." The date and time are lost and "rediscovered" from the far end or set to default (**`70-01-01`** for date and **`00:00:00`** for time). No provisioning information is lost or changed, except for the *page* length parameter in **`set-link`**, which is reset to the default value.

An automatic date and time recovery process takes place by reading the date and time from the remote shelf connected to the main-b interface of the local shelf (in linear applications). In ring applications, the date and time data is recovered from the remote shelf connected to main-b-1 the local shelf.

NOTE 1:
Unlike other commands, an abbreviated version of this command name may not be entered. The user must type the complete command name when entering this command or the command request will be denied.

NOTE 2:
If security is enabled on any CIT or DCC port on a shelf, then this command is available to privileged users only for all CIT or DCC ports on the shelf.

NOTE 3:
If a reset is done on any shelf, all adjacent shelves (shelves at the other ends of the optical interfaces that terminate on the shelf being reset) may show transient "section DCC channel failed" alarms. This is a normal system response.

When input, this command displays the following confirmation message:

```
/* Caution! When executed, this command causes the NE to
   restart the program.  This action will erase all of
   the performance monitoring data and the history file.
   If possible, it will reinitialize the date and time with
   the far end system.
   You have selected the reset command. */

Execute? (y/n or CANcel/DELete to quit) =
```

During system start-up after reset or other initialization, the user who is connected to a CIT port cannot log in. When the user presses RETURN, the following message is issued:

```
/*  System Initialization is in progress.
    Try to log in again later. */
```

NAME

rlgn: Remote Login

INPUT FORMAT

rlgn:*TID;*

DESCRIPTION

This command establishes a remote login session via the SONET data communications channel (DCC). Any network element (NE) which is part of the same maintenance subnetwork and has a compatible product type may be accessed with this command.

The alarm and status report for the far end system is printed automatically when this command is executed.

The input parameter is:

TID TID is the target identifier (system name) of the desired remote shelf.

If the command is successfully completed and security is enabled the user will be prompted for login and password (similar to a local login session).

NOTE:
A remote login session may be terminated unexpectedly if a user elsewhere in the network enables or disables the DCC.

If a user attempts to login to a remote shelf where another remote session is already established, the following denial message will be displayed:

```
RNBY
/* Resource, Ne is BusY */
/* A remote session is not allowed.
   Try again later. */
```

If a user is logged into a shelf and then tries to remotely login to the same shelf, the following denial message will be displayed:

```
SNVS
/* Status, Not in Valid State */
/* Local session already established.
   A remoted login to this TID is not allowed. */
```

If a user has toggled back to the local NE after establishing a remote session and tries to return to the remote session using this command, the following denial message will be displayed:

```
SNVS
/* Status, Not in Valid State */
/* Remote session already established.
   A second remote session is not allowed. */
```

If the user attempts to log into a system whose product type does not support remote logins from the local NE, the following denial message will be displayed:

```
SNVS
/* Status, Not in Valid State */
/* Remote session cannot be established.
   A remoted login to this product type is not allowed. */
```

If a nonprivileged user remotely logs into a remote NE through a DCC in **`lockout`** state, the following denial message will be displayed:

```
PIPW
/* Privilege, Illegal PassWord */
/* Access Blocked. */
```

If an unknown TID (or TID could not be found) is entered, the following message will be displayed and the user will be reprompted for the TID:

```
/* TID entered is not found. */
```

If an unknown TID (NE is unable to determine TID-NSAP translation for the entered TID and TID could not be found) is entered, this command will be denied and the following message displayed:

```
SNVS
/* Status, Not in Valid State */
/* Remote session cannot be established.
   TID entered is not found. */
```

If the entered TID does not match the remote NE's TID, (only the NSAP matched in this case), this command will be denied and the following message displayed:

```
SNVS
/* Status, Not in Valid State */
/* Remote session cannot be established.
   Inconsistent TID.
   NSAP=<XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX> */
```

In the above message, NSAP represents the remote NE's NSAP.

If an NE receives this command and is able to determine a TID-NSAP translation, but the NSAP is unreachable (TID is kept the same, but NSAP must have been changed) or for any other reason, the remote NE is simply not reachable, this command will be denied and the following message displayed:

```
SNVS
/* Status, Not in Valid State */
/* Remote session cannot be established.
   Association setup failure.
   NSAP=<XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX> */
```

In the above message, NSAP represents the one found in the TID-NSAP translation.

RELATED COMMANDS

logout

toggle

rtrv-map-neighbor

rtrv-map-network

NAME

rls-lpbk-ec1: Release-Loopback-EC1

INPUT FORMAT

rls-lpbk-ec1:*Address*[:**lpbktype=***LoopbackType*];

DESCRIPTION

This command releases a previously established loopback on a low-speed STS1E interface.

The input parameters are:

Address Address of EC-1 port(s) where a loopback is to be released. Valid EC-1 Port Addresses: **all, {a,b,c,d}-{1-3,all}**

lpbktype loopbacktype specifies whether the loopback is terminal or facility

- *terminal* terminal loopback directed towards the high speed facility. This is a default value.
- *facility* facility loopback directed towards the DSX.

If the user attempts to release a **facility** loopback type at a valid address when only a **terminal** loopback type has been established, or attempts to release a **terminal** loopback type at a valid address when only a **facility** loopback type has been established, the attempt will be denied and the following denial message displayed:

```
SROF
/* Status, Requested Operation Failed */
/* Specified loopback does not exist. */
```

RELATED COMMANDS

opr-lpbk-ec1

NAME

rls-lpbk-t3: Release-Loopback-T3

INPUT FORMAT

rls-lpbk-t3:*Address*[:**lpbktype=***LoopbackType*];

DESCRIPTION

This command releases a loopback on a DS3 port previously established by an **opr-lpbk-t3** command.

The input parameter is:

Address Address of DS3 port(s) where a loopback is to be released. Valid DS3 Port Addresses: **all, {a,b,c,d}-{1-3,all}**

lpbktype Loopbacktype specifies whether the loopback is terminal or facility, and has one of the following values:

- *terminal* terminal loopback is directed towards the high speed facility. This is the default value.
- *facility* facility loopback is directed towards the DSX-3.

If the loopback type is not consistent with the address, the following denial message is displayed:

```
SNVS
   /* Status, Not in Valid State */
   /* loopback type is not consistent with the address. */
```

RELATED COMMANDS

opr-lpbk-t3

NAME

rstr-passwd: Restore Logins, Passwords, and User Types

INPUT FORMAT

rstr-passwd:*login*,*passwd*,*user_type*,*clr*;

DESCRIPTION

NOTE:
This command is available to privileged users only.

This command is *only* used to restore the login, password (in encrypted and encoded form), and user type information from an external workstation into the network element (NE). The restored information is information that would have been previously loaded from the NE into the external workstation through the **rtrv-passwd** command.

This command is intended to be used *only* in expert mode by an external personal computer or workstation and not at a CIT.

The input parameters are:

login This is the login name that was established by the security administrator on the NE before the **rtrv-passwd** command was executed.

passwd This is the current encrypted and encoded password selected by the owner of the login before the **rtrv-passwd** command was executed.

user_type This is the user access class assigned to this login by the security administrator before the **rtrv-passwd** command was executed. This parameter may have one of the following values:

`privileged`
The privileged user may execute any commands including restricted commands.

`general` The general user may execute any commands that are not restricted to privileged users.

`maintenance`
The maintenance user may only execute commands that access the system, extract reports, and execute maintenance functions through a specific set of commands. No privileged commands are allowed to be executed by maintenance users.

`reports-only`
The reports-only user may only execute basic commands that extract reports from the system.

`clr` This parameter indicates whether the login data existing on the NE should be deleted before the login, password, and user type information can be restored. This parameter may have one of the following values:

`clear` Clear the NE login file before restoring the login information (used only when *`user_type`* is privileged).

`noclear` Append the restored login information to the network element login file.

If this command is executed with the parameter *`clr`* set to `clear`, all login information in the NE login file will be cleared. Then the new login information is restored from the external workstation. However, all active login sessions will not be terminated.

Attempts to input invalid parameter(s) data will result in the user being denied execution of this command. The following denial message is displayed:

```
IDNV
/* Input Data Not Valid, invalid data entered. */
```

An invalid parameter indicates that either a login does not match the valid login definition, the length of the encrypted password (after decoding it into encrypted form) is invalid, a *`user_type`* is invalid (for example, a misspelled *`user_type`*), or a *`clr`* value is invalid (that is, other than clear or noclear).

If this command attempts to restore another login line when the NE's maximum number of supported logins is reached, the following denial message will appear:

```
SLEM
/* Status, List, Exceeds Maximum */
/* Maximum number of logins already exists.
   Cannot enter another login. */
```

If the user attempts to restore another **privileged** user when the maximum number of **privileged** users has already been reached, this attempt will be denied and the following message will be displayed:

```
SLOM
/* Status, List, Over Maximum allowed */
/*  Maximum number of privileged users already exists. */
```

If an attempt is made to restore an already existing **privileged** user's login/password information with a *user_type* of either **general**, **maintenance**, or **reports-only**, this attempt is denied and the following message is displayed:

```
SDNC
/* Status, Data Not Consistent */
/* Privileged user logins cannot be restored as
   General, maintenance or Reports-only. */
```

If an attempt is made to restore a user's login/password information, with a *user_type* of either **general, maintenance** or **reports-only** and *clr*=**clear**, the attempt will be denied and the following message is displayed:

```
SDNC
/* Status, Data Not Consistent */
/* for clr=clear, user_type must be set to privileged. */
```

RELATED COMMANDS

rtrv-passwd

set-lgn

set-passwd

NAME

rtrv-alm: Retrieve Alarm and Status

INPUT FORMAT

rtrv-alm[:alm=*AlarmLevel*];

DESCRIPTION

This command displays a report of active alarm and status conditions at the local network element. The report includes the source address of the alarm as well as date and time of the alarm, whether or not the condition is service-affecting, and a short description of the condition.

The input parameter is:

alm AlarmLevel for which a report is desired. This parameter may have one of the following values:

```
all (default)
cr
mj
mn
pmn
other (abnormal, ne-acty, status conditions)
```

Alarms are listed from greatest to least severity. Within a severity level, newer alarms are listed first.

NOTE:
Due to the large number of conditions reported, the RTRV-ALM report pages have been located at the end of this section for easier reference. Please refer to the RTRV-ALM table (Table 11-3) for a complete description of report outputs.

RELATED COMMANDS

rtrv-hsty

NAME

rtrv-attr-alm: Retrieve Attribute Alarm

INPUT FORMAT

rtrv-attr-alm;

DESCRIPTION

This command displays current alarm attributes, as provisioned by the **set-attr-alm** command.

The output report appears as follows:

```
/* System Alarm Attributes Report
================================================================
Alarm Delay (almdel)=almdel, Clear Delay (clrdel)=clrdel, PMN=pmn
*/
```

The output parameters are:

`Alarm Delay` This shows the alarm holdoff delay in seconds for incoming signal and equipment failures. This parameter is an integer with a range of 0 through 30.

`Clear Delay` This shows the alarm clear delay in seconds for equipment failures. This parameter is an integer with a range of 0 through 30.

`PMN` PMN is the office alarm level to be raised during a power minor alarm condition. This parameter has the values MJ (major) or MN (minor) indicating the alarm level. This parameter does not apply to the OC-12 regenerator.

NOTE:
Incoming signal failure conditions, AIS, and FERF signals are subject to the provisionable alarm holdoff delay and a fixed 15-second clear delay. Yellow signals are not subject to holdoff or clear delays. Circuit pack failures (except control circuit pack failures) are subject to the provisionable alarm holdoff and clear delays.

RELATED COMMANDS

set-attr-alm

NAME

rtrv-attr-cont: Retrieve Attribute Control

INPUT FORMAT

rtrv-attr-cont[:*Address*];

DESCRIPTION

This command displays the provisioned name of miscellaneous discrete environmental control points, as set by the **set-attr-cont** command.

The input parameter is:

Address Address of the environmental control point. The default address is **cont-all**.
Valid Addresses: **cont-{1-4,all}**

The output report appears as follows:

```
/* Control Point Provisioning Report
============================================================
Address  Description
============================================================
cont-1   StartGenerator
cont-2   StartPump
cont-3   control3
cont-4   control4
*/
```

The output parameters are:

`Address` This is the address of the control point.

`Description` This is the provisioned description of the environmental control point.

NOTE:
This command will be denied if it is entered in a system whose SYSCTL CO/RT parameter is set to CO (via the **set-ne** command). Use the **rtrv-ne** command to determine the switch setting. The following denial message will be displayed:

```
ENRI
/* Equipage, Not equipped for Retrieving specified Information */
/* Environmental controls can be provisioned only in RT systems. */
```

RELATED COMMANDS

rtrv-attr-env

rtrv-ne

set-attr-cont

set-attr-env

NAME

rtrv-attr-env: Retrieve Attribute Environment

INPUT FORMAT

`rtrv-attr-env`[:*`Address`*];

DESCRIPTION

This command displays the provisioned alarm and provisioned name and provisioned alarm type of miscellaneous discrete environmental alarm/status points, as set by the **`set-attr-env`** command.

The input parameter is:

`Address` The address of the environmental input point.
Valid Addresses: **`env-{1-21}`**, **`env-{all}`** (default)

The output report appears as follows:

```
/* Environmental Alarm Provisioning Report
============================================================
Address  Alarm  Alarm Type      Description
============================================================
env-1     CR    MISC            Fire
env-2     NA    Power           OpenDoor
env-3     MN    code-7          environment3
 .        .       .              .   .   .
 .        .       .              .   .   .
 .        .       .              .   .   .
env-15    MN    Misc            externalMinor
env-21    MN    Misc            generatorOn
*/
```

The output parameters are:

`Address` The address of the environmental alarm/status point.

`Alarm` Alarm is the provisioned alarm level of the environmental input and has the following values:

- `CR` Critical alarm
- `MJ` Major alarm
- `MN` Minor alarm
- `NA` Not alarmed, but reported

`Alarm Type` This is the user-defined classification of the environmental alarm/status point.

`Description` Provisioned description of the environmental alarm/status point.

NOTE:
This command will be denied if it is entered in a system whose SYSCTL CO/RT parameter is set to CO (via the **`set-ne`** command). Use the **`rtrv-ne`** command to determine the switch setting. The following denial message will be displayed:

```
ENRI
/* Equipage, Not equipped for Retrieving specified Information */
/* Environmental alarms can be provisioned only in RT systems. */
```

RELATED COMMANDS

rtrv-attr-cont

rtrv-ne

set-attr-cont

set-attr-env

NAME

rtrv-crs-sts1: Retrieve Cross-Connection STS-1

INPUT FORMAT

rtrv-crs-sts1[:*Address*];

DESCRIPTION

This command retrieves STS-1 cross-connections within the DDM-2000 system. Cross-connections are entered using the **ent-crs-sts1** command.

For OC-12, STS-3c cross-connections are possible between Main-B slots and any function unit slots and will be displayed in this report.

STS-3c cross-connections are an optional feature that requires a special license from Lucent Technologies. See Chapter 8, "Administration and Provisioning," for additional information.

The input parameter is:

Address The address of one or more STS-1 channels for which cross-connections are to be reported. The default address is **all** STS-1 channels in the system.

Valid Ring Addresses: **all, mb-{1-12,all}, {a,b,c,d}-{1-3,all}**

The output report appears as follows:

```
   /* Cross-Connection Map Report
   ================================================================
   Address  Address                Cross Connect  Ring Id
      1        2                      Type
   ================================================================
   ------------------------------STS-3C----------------------------
   mb-10     c-1                      twoway         -
   mb-11     c-2                      twoway         -
   mb-12     d-1                      dc             mb1
   ------------------------------STS-1-----------------------------
   mb-1     mb-1                      twoway         -
   mb-7      b-1                      dc             mb1
    a-1     mb-4                      twoway         -
*/
```

NOTE:
Starting with OC-12 Release 7.0 each cross-connection is reported only once (not once in each direction).

The above report lists both STS-1 and STS-3c cross connections (if applicable) in separate sections. The output report shows the channels in an order that reflects the physical layout of the system (for example, the high-speed slots are shown first, followed by those associated with function unit A, function unit B, etc.).

Also the STS-3c section within the OC-3 report is applicable if the main unit slots are equipped with OC-12 interfaces (24G-U OLIU circuit packs).

The output parameters are:

`Address 1` Address 1 is the address of an STS-1 channel.

`Address 2` Address 2 is the address of an STS-1 channel.

`Cross Connect Type`
This column specifies whether the cross-connection is two-way (**`twoway`**) or drop and continue (**`dc`**). Two-way cross-connections apply to terminating, hub, add/drop, pass-through, hairpin, 0x1 ring, dual locked, and 0x1 DS3 configurations. For detailed information on the mentioned cross-connection types, refer to **`ent-crs-sts1`** command page.

`Ring Id` This column identifies the ring for drop and continue connections, specifying which ring will be continued as well as dropped at the network element. The valid values are **`mb1`** and **`mb2`**.

RELATED COMMANDS

dlt-crs-sts1

ent-crs-sts1

NAME

rtrv-crs-sts3c: Retrieve Cross-Connection STS-3c

INPUT FORMAT

rtrv-crs-sts3c[:*Address***]**;

DESCRIPTION

This command retrieves STS-3c cross-connections within the DDM-2000 system. Cross-connections are entered using the **ent-crs-sts3c** command.

This command is available with OC-12 ring releases.

NOTE:
If Slots 1 and 2 are equipped with different pack types (for example, during an upgrade), this report will include data for what is considered at the time as the valid system pack type.

The input parameter is:

Address The address of one or more STS-3c channels for which cross-connections are to be reported. The default address is **all** STS-3c channels in the system.

Valid OC-12 ring STS-3c Addresses are: **all, mb-{1,4,7,l0,all}, {a,b,c,d}-1**

The output report appears on the following page.

```
   /* Cross-Connection Map Report
   ================================================================
   Address  Address                Cross Connect  Ring for
      1        2                      Type       Drop&Cont
   ================================================================
   ------------------------------STS-3C--------------------------
   mb-1     mb-1                      twoway         -
   mb-4      a-1                      dc             mb1
   mb-7      b-1                      rtv            -
    a-1     mb-4                      dc             mb1
    b-1     mb-7                      rtv            -
   ------------------------------STS-1---------------------------
   mb-10     c-1                      twoway         -
   mb-11     c-2                      twoway         -
   mb-12     d-1                      dc             mb1
    c-1     mb-10                     twoway         -
    c-2     mb-11                     twoway         -
    d-1     mb-12                     dc             mb1
*/
```

The output report shows the STS-3c channels in an order that reflects the physical layout of the system (for example, the high-speed slots are shown first, followed by those associated with function unit A, function unit B, etc.). The output report also shows the STS-1 channels (if applicable) in a separate section. The STS-1 channels are listed in the same order as described for the STS-3c channels.

The output parameters are:

`Address 1` Address 1 is the address of an STS-3c channel.

`Address 2` Address 2 is the address of an STS-3c channel.

`Cross Connect Type`
This column specifies whether the cross-connection is two-way (**`twoway`**) , drop and continue (**`dc`**), video cross-connections at CO site (**`cov`**), or video cross-connections at RT sites (**`rtv`**).

`Ring for Drop&Cont`
This column identifies the ring for drop and continue connections, specifying which ring will be continued as well as dropped at the network element. The valid values are **`mb1`** and **`mb2`**.

RELATED COMMANDS

ent-crs-sts3c

dlt-crs-sts3c

NAME

rtrv-ec1: Retrieve EC-1

INPUT FORMAT

rtrv-ec1[:*Address*];

DESCRIPTION

This command retrieves information about each EC-1 port. This information includes attributes set by the **set-ec1** command, as well as parameters set by switches on the circuit pack.

The input parameter is:

Address This is the address of one or more EC-1 ports. The default address is **all** EC-1 ports in the system.

Valid Addresses: **all, {a,b,c,d}-{1-3,all}**

The output report appears as follows:

```
/* EC1 Port Provisioning Report
================================================================================
 Port         Alarm  Signal Degrade  State
Address       Level    Threshold
================================================================================
address       alarm       nn         state
address       alarm       nn         state
  .             .          .           .
  .             .          .           .
  .             .          .           .
  .             .          .           .
*/
```

The output parameters are:

`Port Address` This column lists the address of one or more EC-1 ports.

`Alarm Level` This column shows the alarm level for an incoming EC-1 signal failure and may have one of the following values:

- `CR` Critical
- `MJ` Major
- `MN` Minor
- `NA` Not Alarmed

`Signal Degrade` This column shows a signal degrade threshold for the EC-1 port as a BER in terms of a logarithm to the base 10. The value may be an integer ranging from -9 through -5. For OC-12 systems, this parameter may also be set to -3 as a loss-of-signal threshold. However, the OC-12 system always reports a threshold crossing as a signal degrade.

`State` This column shows the memory administrative state of the port. When the mode is set for **`High Speed`**, the state is always `is` (in-service). When the mode is set for **`Low Speed`**, the state may be one of the following values:

- `is` In-service
- `auto` Automatic
- `nmon` Not Monitored

RELATED COMMANDS

set-ec1

NAME

rtrv-eqpt: Retrieve Equipment

INPUT FORMAT

rtrv-eqpt[:*Address*];

DESCRIPTION

This command displays the circuit pack type and version information for one or more slots on a network element (NE).

The input parameter is:

Address Address identifies one or more slot(s). The default is **all** slots. Valid Slot Addresses: **all, main-{a,b,all}-{1-2,all}, tsi-{1,2,all}, fn-{a,b,c,d,all}-{1,2,all}, tg-{1,2,all}, sysctl, auxctl**

A sample output report appears on the following page.

```
/* Equipage and Version Report
=================================================================
   Slot     Circuit  Apparatus  Series     CLEI      ECI     Serial
   Address   Pack       Code    Number     Code      Code    Number
   ================================================================
   ----------------------------------------------------------------
   tg-1     TGS      BBF2B      S3:3    SNPQA16AAA  688751  93MV08036171
                                       PID=AGAEC
   tg-2     TGS      BBF2B      S1:1    SNPQAJCAAA  680153  92MV09585817
                                       PID=AEKCG
   ----------------------------------------------------------------
   main-a-1 -        -          -       -           -       -
   main-a-2 -        -          -       -           -       -
   main-b-1 OLIU     23G       S1:3     SNPQWAVAAC  682351  92MV07654909
   main-b-2 OLIU     23G       S1:4     SNPQWXCVIA  681391  93MV09513420
   ----------------------------------------------------------------
   tsi-1    TSI      BCP3      S2:41    SNPQBRRAUL  687933  93MV10032913
   tsi-2    TSI      BCP3      S2:41    SNPQBKMABL  684973  93MV10148184
   ----------------------------------------------------------------
   fn-a-1   OLIU     21G       S1:2     SNTRABCAAB  670537  90MV12066805
   fn-a-2   OLIU     21G       S1:2     SNTRABCAAB  670537  90MV12066805
   fn-b-1   3DS3     BBG11     S1:5     SNRELPWCWQ  689123  91MV69312421
   fn-b-2   -        -          -       -           -       -
   fn-c-1   OLIU     21G       S1:2     SNTRABCAAB  670537  92MV04595265
   fn-c-2   OLIU     21G       S1:2     SNTRABCAAB  670537  92MV04595265
   fn-d-1   -        -          -       -           -       -
   fn-d-2   -        -          -       -           -       -
   ----------------------------------------------------------------
   sysctl   SYSCTL   bbg8       S1:1     SNC11WOAAA  205700  94MV00000017
   ----------------------------------------------------------------
   auxctl   OHCTL    bcp4       S1:1     SNC11VLAAA  205701  94MV00000010

            Program version X.X.X
   */
```

The output parameters are:

`Address`	This is the address of the slot.
`Circuit Pack`	Circuit pack is the mnemonic name that identifies the general type function provided by a circuit pack. For example, Optical Line Interface Units are all named OLIU; SYStem ConTroLlers are named SYSCTL.
`Apparatus Code`	Apparatus code uniquely identifies the specific function provided by a circuit pack. Circuit packs with different apparatus codes are not interchangeable even if they have the same name.
`Series Number`	This is used to indicate interchangeability among circuit packs with the same circuit pack name and apparatus code but different manufacturing versions. In general, a circuit pack can be replaced by another circuit pack that has the same apparatus code and the same or later series number.
`CLEI Code`	*CLEI** code is the 10-character code identifying each circuit pack.
`ECI Code`	Equipment catalog item (ECI) code is a 6-character code identifying each circuit pack. This code corresponds to the bar-coded label on the faceplate of the circuit pack, and is uniquely equivalent to the *CLEI* code.
`Serial Number`	This is a 12-character code uniquely identifying each circuit pack and indicating the date and place of manufacture.
`Program Version`	Program version is the version of software that is currently stored on the circuit pack.
`PID`	Program identification code identifies the version of firmware on one or more socketed devices on the circuit pack.

The report always contains a line for every slot included in the range of the address whether or not the slot is equipped.

Hyphens (-) indicate information in that field is not applicable (that is, type and version information for slots that are not equipped).

Question marks (?) indicate that the information is unknown (for example, an unrecognized circuit pack, because the system is unable to read version information from a circuit pack inserted into a slot in the AUTO state)

---

* COMMON LANGUAGE is a registered trademark and CLEI, CLLI, CLCI, and CLFI are trademarks of Bell Communications Research, Inc.

If an incorrect circuit pack is inserted in a slot, the report will show the expected circuit pack name for that slot and indicate that the current circuit pack does not match inventory.

If a faulty circuit pack with unreadable version recognition information is placed in a slot, the report will indicate that the circuit pack is failed and version information is unrecognizable.

If the system cannot report complete and correct version information for a circuit pack because of a field upgrade, then the information that may be incorrect (apparatus code, series, *CLEI* code, and ECI code) is followed by a "?".

RELATED COMMANDS

rtrv-state

NAME

rtrv-feat: Retrieve Feature

INPUT FORMAT

`rtrv-feat`;

DESCRIPTION

This command retrieves a list of active feature options enabled by the **`set-feat`** command.

The output report appears as follows:

```
/* Feature Options Enabled Report
=================================================================
 Feature Option     Description
=================================================================
     feature        description
     feature        description
      .                 .
      .                 .
      .                 .
      .                 .
*/
```

The output parameters are:

`Feature Option` This is the name of the feature currently enabled.

`Description` Description of the feature.

RELATED COMMANDS

set-feat

NAME

rtrv-fecom: Retrieve Far-end Communications

INPUT FORMAT

rtrv-fecom:[*Address*];

DESCRIPTION

This command displays the provisioned state of a network element's (NE's) section data communication channels (DCC), and of the IAO LAN interface, as set by the **set-fecom** command.

The DCC is an embedded overhead communications channel in the SONET line used for end-to-end communications and maintenance. The DCC carries alarm, control, and status information between NEs.

The input parameter is:

Address Address is the address of the DCC or IAO LAN. The default value is **dcc-all**

Valid Ring Addresses (1+1): **dcc-{mb1,mb2,a,b,c,d,all}**

Valid Ring Addresses (dual 0x1 or video): **dcc-all, dcc-{mb1,mb2,a1,a2,b1,b2,c1,c2,d1,d2}**

Valid IAO LAN Address: **lan**

The far-end communication output report appears as follows:

```
/* Far End Communication Configuration Report
================================================================
 DCC/LAN       Communications   DCC
 Address                        NS/US
================================================================
 dcc-c            disabled     ns
 dcc-m-b          enabled      us
 dcc-d            enabled      us

 lan              enabled
 dcc-b            disabled     ns

*/
```

The output parameters for this report are:

`DCC/LAN Address`	This column displays the address of a DCC or IAO LAN.
`Communication`	This column shows whether communication over the DCC or IAO LAN is enabled or disabled.
`DCC NS/US`	DCC network side/user side (NS/US) parameter settings are available with the BBG8 controller to identify the setting of each end of the DCC in the network element. This identification is needed for OSI communications and is required for all nodes in the subnetwork. To avoid alarms, only one end of a span may be designated as the user side and only one end of a span may be designated as the network side.

RELATED COMMANDS

rtrv-map-neighbor

rtrv-map-network

rtrv-x25

set-fecom

NAME

rtrv-hsty: Retrieve History

INPUT FORMAT

`rtrv-hsty`;

DESCRIPTION

This command displays an event-history report. This report contains a list of the most recent system events. This report will contain up to 500 events. The events are listed in last-in, first-out order, and are date- and time-stamped.

NOTE:
Due to the large number of conditions reported, the RTRV-HSTY report pages have been located at the end of this section for easier reference. Please refer to the RTRV-HSTY table (Table 11-4) for a complete description of report outputs.

RELATED COMMANDS

rtrv-alm

NAME

rtrv-lgn: Retrieve Login

INPUT FORMAT

`rtrv-lgn`;

DESCRIPTION

This command retrieves login authorization information. This report lists each user's login and privileges. The report does not contain passwords.

NOTE:
This command is available to privileged users only.

The output report appears as follows:

```
/* Login Provisioning Report
=====================================================================
  Login          User Type
=====================================================================
  name           privileged
  name           privileged
  name           privileged
---------------------------------------------------------------------
  name           general
   .                .
   .                .
---------------------------------------------------------------------
  name           maintenance
   .                .
   .                .
---------------------------------------------------------------------
  name           reports-only
   .                .
   .                .
*/
```

The output parameters are:

`Login` This column lists the login names.

`User Type` This column indicates the type of authorization each user is assigned. The valid values are **`privileged`**, **`general`**, **`maintenance`**, and **`reports-only`**.

Privileged logins are listed first in the report, followed by general logins, maintenance logins, and then reports-only logins. Each category of logins is separated by a row of hyphens.

NOTE:
There are always three (and only three) privileged logins on the DDM-2000 system.

RELATED COMMANDS

set-lgn

set-secu

rtrv-secu

NAME

rtrv-link: Retrieve CIT Link Configuration

INPUT FORMAT

`rtrv-link;`

DESCRIPTION

This command displays the currently-provisioned parameters for the user's craft interface link, as set by the **`set-link`** command. This includes the link which the user is logged into, the baud rate, and the page length of reports.

The baud rate is set by autobaud and is not a provisionable parameter.

The output report appears as follows:

```
/* Interface Link Configuration Report
============================================================
Link=link, PageLength (pg)=pg, Baud=baud (auto)
*/
```

The output parameters are:

`Link` Link identifies the CIT link from which the command was executed and may have the following values:

- `cit-1` This indicates the front-access port.
- `cit-2` The rear-access port.
- `dcc-`*`x`* A SONET DCC port used for remote access (**`dcc-mb`**, **`dcc-a`**, **`dcc-b`**, **`dcc-c`**, or **`dcc-d`**).

`PageLength` This is the number of lines displayed in one page of a report. Reports with a number of lines greater than one page will be paged.

`Baud` Baud identifies the data rate for this link. The CIT data rate is automatically set to agree with the terminal or workstation connected to the link. The (`auto`) after the data rate indicates that the data rate is set by the autobaud routine on the SYSCTL circuit pack. After connecting to the CIT port, press <enter><enter> or <CR><CR> (double carriage return) or "AA"

or "aa" to allow the system to automatically set its baud rate to the rate of the terminal or workstation attached to the port.

RELATED COMMANDS

set-link

rtrv-ne

NAME

rtrv-map-neighbor: Retrieve Neighbor Map

INPUT FORMAT

`rtrv-map-neighbor`;

DESCRIPTION

NOTE:
This command page describes the functionality of the **`rtrv-map-neighbor`** command in OC-12 Release 7.0 and later OC-12 TARP releases.

This command displays the immediate DCC and/or IAO LAN neighbors that are reachable by the local Network Element (NE).

The TIDs included in this report are always determined by real-time TARP NSAP-to-TID queries, even if TARP Data Cache is enabled.

If this command is issued to a NE provisioned as a Level 2 IS, the report will list the default neighboring NEs provisioned as Level 2 (if any) and/or Level 1 ISs within the same Area, as well as other Level 2 neighboring ISs included in other Areas.

NOTE 1:
If the local NE is a Level 2 IS, this will be indicated in the report. The only other Level 2 IS that can be identified in the report is the default Level 2 IS (if local NE is not the default Level 2 IS).

NOTE 2:
Network Elements provisioned as neighbors through TARP Manual Adjacency are not listed as neighbors in this report. This information can be obtained through the **`rtrv-ulsdcc`** report.

NOTE 3:
Adjacent NEs provisioned as Level 1 ISs across multiple Level 1 areas will not be listed as neighbors in this report.

For more explanation on the Level 1 and Level 2 routing and the IS/ES terminology, refer to 824-102-144, *Lucent Technologies 2000 Product Family Multi-Vendor Operations Interworking Guide*.

The following is an example report under normal conditions and it is applicable to OC-12 Release 7.0 and later:

```
/* Neighbor Map for local_system
=========================================================================
TID                   Connected Thru    Product Type        Level 2 IS
 NSAP
=========================================================================
local_system                            DDM-2000 OC-12      Y
 39 840F 80 000000 0000 0000 0000 08006alad06e 00
R5                    lan
 39 840F 80 000000 0000 0000 0000 00000e3a0273 00
R6                    lan                                    Y
 39 840F 80 000000 0000 0000 0000 08006alad07f 00
Site3NE1              main-1
 39 840F 80 000000 0000 0000 0000 00000e3a0732 00
Site7NE1              main-2
 39 840F 80 000000 0000 0000 0000 00000e3a0372 00
*/
```

Note that the NSAP value is part of the same line as the other reported information, but it is wrapped around based on an 80-column screen width.

NOTE 1:
If Multiple Area Addresses have been provisioned at any other NE in the local NE's area, and a TARP NSAP-to-TID translation for a remote NE is successfully completed, this report will only list the information corresponding to the primary NSAP of the remote NE. A remote NE's primary NSAP is the NSAP for which the remote NE responds successfully to an NSAP-to-TID TARP query.

NOTE 2:
In the event Multiple Area Addresses are used for an NE in the local NE's area, and none of the TARP NSAP-to-TID queries were successful, this report will list each of the possible NSAPs (each NSAP corresponding to one of the multiple Area Addresses) for the remote NE, along with a "?" displayed in the TID column.

The local NE is listed first in the report. The rest of the entries are sorted by channel number or `Connected Through` Address.

The output report contains two lines for each neighbor system with which the local NE is communicating via SONET section DCC and/or IAO LAN

The output report parameters are:

`TID` This column contains the TID of the local NE and its direct DCC and/or IAO LAN neighbors.

Any time the local NE is unable to determine the TID for its neighbor's NSAP, this report will indicate this by showing a "?" in the TID column.

`Connected Through`
This column contains the address of the optical lines and/or IAO LAN through which the local NE is directly connected to the NE identified in the `TID` column.

NOTE:
In the event of a DCC or IAO LAN link failure between the local NE and its immediate neighbor occurs, the line corresponding to this NE will be removed from the report.

`Product Type` This is the product type of the local NE.

`Level 2 IS` This column identifies whether the listed Network Element is provisioned as a level 2 IS. Possible values are: "Y" or " ".

`NSAP` The NSAP address is a 20-byte (40-character) address required by OSI to provide unique identification within the OSI network and consists of a number of fields, some of which are pre-defined and some of which are user-settable. The structure of the NSAP is shown in the following display.

NSAP Structure

NSAP Field:	AFI	IDI	IDI PAD	DFI	Organization ID	RES	RD	Area	System Identifier	SEL
Bytes:	1	2		1	3	2	2	2	6	1
Default Value: (hex)	39	840	F	80	000000	0000	0000	0000	none	00
	not provisionable				user provisionable				not provisionable	

For more information on the NSAP's individual fields, refer to the **`ent-ulsdcc`** command page.

The different fields that make up the NSAP address are separated by a single space in the report. If local NE is an OC-12 shelf and any function unit (for example, fn-b) has OC-3 packs in both slots, and the OC-3 packs are being used in a Single-Homed 0X1 ring application to connect function unit 1 (fn-b-1) to an

OC-3 shelf and function unit 2 (fn-b-2) to another OC-3 shelf; the corresponding report will list each neighbor with the specific function unit and slot number under "Connected Through". The report will be displayed as follows:

```
/* Neighbor Map for NE1
=========================================================================
TID                   Connected Thru    Product Type    Level 2 IS
 NSAP
=========================================================================
NE1                                     DDM-2000 OC-12
39 0840 80 000000 0000 0000 0000 08006alad06e 00
R2                    fn-b-1
39 0840 80 000000 0000 0000 0000 08006alad07f 00
R4                    fn-b-2
39 0840 80 000000 0000 0000 0000 00000e3a0273 00
Site3NE1              main-b-1
39 0840 80 000000 0000 0000 0000 00000e3a0372 00
Site7NE1              main-b-2
39 0840 80 000000 0000 0000 0000 08006alad06f 00
*/
```

RELATED COMMANDS

rtrv-map-network

NAME

rtrv-map-network: Retrieve Network Map

INPUT FORMAT

rtrv-map-network[:Level2=*level2***]**;

DESCRIPTION

NOTE:
This command page describes the functionality of the **rtrv-map-network** command in OC-12 Release 7.0 and later OC-12 TARP releases.

This command displays all Network Elements (NEs) in the same Level 1 area that are reachable by the local NE through the DCC or IAO LAN.

The TIDs included in this report are always determined by real-time TARP NSAP-to-TID queries, even if TARP Data Cache is enabled.

For more explanations on the Level 1 and Level 2 routing and the IS/ES terminology, refer to 824-102-144, *Lucent Technologies 2000 Product Family Multi-Vendor Operations Interworking Guide*.

The input parameter is:

level2 This parameter is available starting from OC-12 release 7.0. Level 2 indicates whether the report should list all reachable NEs provisioned as Level 2 ISs across multiple areas within a subnetwork. Possible values are either "Y" or "N" with a default value of "N". This parameter is only supported if the local NE is provisioned to be a Level2 IS.

This is an optional parameter. By default, the report lists all reachable NEs, and the Level 2 IS(s) (if any) that are included in the local NE's area only.

NOTE:
If the local NE is a Level 2 IS, this will be indicated in the report also.

To list all Level 2 ISs across all areas, this command must be submitted to a NE provisioned as a Level 2 IS, and the value of **level2** parameter must be set to "Y".

If this command is issued to an NE that is not provisioned as a Level 2 IS and the value of **level2** is set to "Y", the command will be denied and the following message displayed:

```
IDEI
/* Input, Data Entry Invalid */
/* Network Element must be a Level 2 IS. */
```

The following is an example output report:

```
/* Network Map for local_system
=========================================================
TID                    Product Type          Level 2 IS
NSAP
=========================================================
local_system           DDM-2000 OC-12
 39 840F 80 000000 0000 0000 0000 08006alad06e 00
R5
 39 840F 80 000000 0000 0000 0000 00000e3a0273 00
R6
 39 840F 80 000000 0000 0000 0000 08006alad07f 00
Site3NE1
 39 840F 80 000000 0000 0000 0000 00000e3a0732 00
Site7NE1
 39 840F 80 000000 0000 0000 0000 00000e3a0372 00
*/
```

Note that the NSAP value is part of the same line as the other information, but is wrapped around based on an 80-column screen width.

The local NE is listed first in the report. The rest of the entries are sorted by TID.

The output report parameters are:

`TID` This column contains the TID of the local and remote NEs in the subnetwork.

Any time the local NE is unable to determine a TID for a reachable NSAP, the network map report indicates this by showing a "?" in the TID column.

NOTE:
When "?" is displayed in the report, it will always appear, along with the related information at the end of the report.

`Product Type` This is the product type of the local NE (for example, DDM-2000 OC-3).

`Level 2 IS` This column identifies whether the listed NE is the default Level 2 IS. If local NE is a Level 2 IS, this will be indicated by "Y" under this column. Possible values are: "Y" or " ". The blank indicates a non-Level 2 IS (Level 1 NE).

NSAP The NSAP address is a 20-byte (40-character) address required by OSI to provide unique identification within the OSI network and consists of a number of fields, some of which are pre-defined and some of which are user-settable. The structure of the NSAP is shown in the following display.

NSAP Structure

NSAP Field:	AFI	IDI	IDI PAD	DFI	Organization ID	RES	RD	Area	System Identifier	SEL
Bytes:	1	2		1	3	2	2	2	6	1
Default Value: (hex)	39	840	F	80	000000	0000	0000	0000	none	00
	not provisionable				user provisionable				not provisionable	

For more information on the NSAP's individual fields, refer to the **`ent-ulsdcc`** command page.

The report lists the different fields that make up the NSAP address separated by a single space.

If some NEs that have duplicate TIDs were found in the same subnetwork, they will both be reported in the report.

If an NE becomes isolated, and if the user were to run this report while this condition still exists, the isolated NE would no longer be listed in the report; only NEs that are reachable by the local NE are listed.

NOTE 1:
If Multiple Area Addresses have been provisioned at any other NE in the local NE's area, and a TARP NSAP-to-TID translation for a remote NE is successfully completed, this report will only list the information corresponding to the primary NSAP of the remote NE. A remote NE's primary NSAP is the NSAP for which the remote NE responds to an NSAP-to-TID TARP query.

NOTE 2:
In the event Multiple OSI Network Layer Area Addresses have been provisioned at any other NE in the local NE's area, and none of the TARP NSAP-to-TID queries were successful, this report will list each of the possible NSAPs (each NSAP corresponding to one of the multiple Area Addresses) for the remote NE, along with a "?" displayed in the TID column.

RELATED COMMANDS

rtrv-map-neighbor

NAME

rtrv-ne: Retrieve Network Element

INPUT FORMAT

`rtrv-ne;`

DESCRIPTION

NOTE:
This command page describes the functionality of the **`rtrv-ne`** command in OC-12 Release 7.0 and later OC-12 TARP releases.

This command displays the information that is provisioned by the **`set-ne`** command and set by switches on the SYSCTL pack.

The output report appears as follows:

```
/* System Provisioning Report
============================================================
TID=system_name
GNE=active|not active
IDLE=ais|unequipped
Shelf=number
CO/RT Selector=location
Product=value  (hw)
Dormant_Release=dormant_release
Apply:Action=action    Schedule:Date=date Time:time
*/
```

The (hw) after a parameter value indicates that the parameter is set by hardware switches on the BBG8 SYSTCL.

The output parameters are:

`TID`	This is the system name, indicated by a string of up to 20 alphanumeric characters. The default value for `TID` is "LT-DDM-2000". The `TID` must be unique for each element in a subnetwork.
`GNE`	The GNE field is used to identify whether this system is the gateway network element (GNE), providing TL1 interface. It has a value of either `active` or `not active`.
`IDLE`	If value is `ais`, the system will insert an Alarm Indication Signal toward the SONET line when channels are not cross-connected or not equipped with path terminating equipment. If

value is `unequipped`, the system will insert the unequipped signal toward the SONET line when channels are not cross-connected or not equipped with path terminating equipment.

`Shelf` Shelf is the shelf address (`1-8`). It identifies the physical position of the shelf in a bay.

`CO/RT Selector`
Two types of TBOS displays are provided to support central office and remote terminal applications. The CO/RT Selector identifies either a central office (CO) shelf or a remote terminal (RT) shelf to control the TBOS display formats and operation of the miscellaneous discrete points and fan control relays.

`Product` Product is a keyword that is set by switches on the BBG8 SYSCTL and the value of the SHELFID pin (DDM shelf or ARM shelf) of the backplane to identify the product to be supported.

`DDM-2000 OC-3`
The shelf is part of a DDM-2000 network. The software also checked for the OHCTL and determined that the product is OC-3 (BBG9 or BBG10).

`DDM-2000 OC-12`
The shelf is part of a DDM-2000 network. The software also checked for the OHCTL and determined that the product is OC-12 (BCP4).

`SLC-2000 ARM`
The shelf is part of a *SLC*®-2000 Access System ARM network. The software also checked for the OHCTL and determined that the product is OC-3 (BBG9 or BBG10).

`DDM-2000 FiberReach`
The shelf is part of a FiberReach network. The OHCTL is not a part of the shelf.

`Dormant_Release`
This parameter is reported starting with OC-12 Release 5.1. If a dormant software generic or release is currently stored by the network element, this parameter will report the release number in the form XX.XX.XX. The value of this parameter can be either one of the following:

`XX.XX.XX` A dormant software generic exists locally.

`none` No dormant software generic exists locally or the dormant software is corrupted.

`Apply`

`Action` This parameter is reported starting with OC-12 Release 7.0. If a dormant software generic is currently stored by the network element, and the **`apply`** command is scheduled for program installation with `Action=`**`install`** on `Date=`**`date`** and `Time=`**`time`**, the date is reported as a 6 digit YYMMDD, and time as HH:MM:SS

If no program installation is scheduled yet, a blank " " is reported under Action. Date and time will report blank " " values also (example: Date= Time=)

If a dormant software generic is currently stored by the network element, and the **`apply`** command is scheduled with `Action=`**`cancel`**, a blank " " is reported for Action. Date and time will report blank " " values also (example: Date= Time=)

`Schedule`

`Date` This parameter is reported starting with OC-12 Release 7.0. If the **`apply`** command is scheduled for program installation with `Action=`**`install`** on `Date=`**`date`**. This parameter is reported as a 6 digit YYMMDD.

`Time` This parameter is reported starting with OC-12 Release 7.0 if the **`apply`** command is scheduled for program installation with `Action=`**`install`**. This parameter is reported as HH:MM:SS

`macaddress` This parameter is applicable to only OC-12 Release 7.0 and later OC-12 TARP releases. This is the Media Access Control (MAC) address of the IAO LAN. This address is stored (burned) on the OHCTL circuit pack's EEPROM by the factory and it is unique.

The 6 bytes of the MAC address are displayed as 12 hexadecimal digits. The following is an example of a MAC address: "08006alad06e".

RELATED COMMANDS

rtrv-map-network

NAME

rtrv-oc3: Retrieve OC3

INPUT FORMAT

`rtrv-oc3`[:*`Address`*];

DESCRIPTION

This command displays the configuration of OC-3 lines, as set by the **`set-oc3`** command.

The input parameter is as follows:

`Address` Address identifies the OC-3 line(s). The default is **`all`**.
Valid Addresses: **`all, fn-{a,b,c,d}-{1,2,all}, fn-all`**

The output report appears as follows:

```
/* OC-3 Line Provisioning Report
================================================================================
 Line    Signal Degrade  Optical        Sync   Application   AIS
Address    Threshold     Power (hw)    Message              Alarm
================================================================================
address        n            x          message  application  alm
address        n            x          message  application  alm
  .            .            .             .         .         .
  .            .            .             .         .         .
*/
```

The `Concat` mode is only visible in linear DDM-2000 releases where the STS-3c mode has been enabled with the **`set-feat`** command.

The output parameters are:

`Line Address` Address of the OC-3 line.

`Signal Degrade Threshold`
This is the bit error rate (BER) threshold shown as a logarithm to the base 10. The value of *n* is an integer with a range of -5 through -9 corresponding to BERs of 10^{-5} through 10^{-9}, respectively.

`Optical Power` This is the current setting of the optical power switch on the OLIU circuit pack carrying the specified OC-3 signal. The (hw) after `Optical Power` indicates that the optical power

setting is determined by a hardware switch on the OLIU circuit pack. This parameter may have the following values:

`high` High optical power

`low` Low optical power

— A hyphen indicates that optical power is not settable by switches on the OLIU circuit pack.

`Kbyte Message` The valid values for this parameter are `enabled`, indicating that proprietary Sync messages are used, and `disabled`, indicating that proprietary Sync messages are not used. The Sync messages use the K2 byte in the SONET overhead to determine synchronization quality. These values are set by the **`set-oc3`** command.

`Sync Message` This parameter indicates the type of synchronization messaging that has been provisioned for that OC-3 optical interface by the **`set-oc3`** command. The valid values for this parameter are `Kbyte` (default value), `Sbyte`, and `disabled`. The sync messages use the K2 byte or the S1 byte in the SONET line overhead to determine synchronization quality.

`Application` This parameter is available in all OC-12 ring releases only. This report parameter defines additional behavior assigned to this function unit. If this parameter is set to `0x1`, the function unit is part of an OC-12 0x1 ring application. If this parameter is set to `video` or `0x1`, there is no protection switching between the packs in a function unit pair.

`AIS Alarm` This parameter specifies the alarm level of a non-service-affecting OC-3 line AIS failure condition. The valid values are:

`cr` Critical alarm

`mj` Major alarm

`mn` Minor alarm

`na` Not alarmed, but reported (default).

RELATED COMMANDS

rtrv-sync

NAME

rtrv-oc12: Retrieve OC12

INPUT FORMAT

rtrv-oc12[:*Address*];

DESCRIPTION

This command displays the configuration of OC-12 lines provisioned by the **set-oc12** command.

The input parameter is as follows:

Address Address identifies the OC-12 line(s). The default is **all**.
Valid addresses: **all, main-b-{1,2,all}**

NOTE:
If slot 1 and 2 are equipped with different pack types (for example, during an upgrade), this report will include data for what is considered at the time as the valid system pack type.

The output report appears as follows:

```
/* OC-12 Line Provisioning Report
============================================================
 Line    Signal Degrade   Sync      AIS
Address    Threshold     Message   Alarm
============================================================
address         -n       message    alm
address         -n       message    alm
  .              .          .        .
  .              .          .        .
  .              .          .        .

*/
```

The output parameters are:

`Line Address` Address of the OC-12 line.

`Signal Degrade Threshold`
This is the bit error rate (BER) threshold as a logarithm to the base 10. The value of *n* is an integer with a range of -5 through -9 corresponding to BERs of 10^{-5} through 10^{-9}. If a slot is empty or equipped with something other than an OC-12 optical unit, a hyphen (-) will appear in this column.

`Kbyte Message` This parameter is available in Release 5.0 and earlier. It represents the current provisioned state of each OC-12 line to support the synchronization message using the K2 bytes in the SONET overhead. The valid values are **`enabled`**, indicating that proprietary Sync messages are used, and **`disabled`**, indicating proprietary Sync messages are not used.

`Sync Message` For OC-12 Release 5.1 and later ring releases, this parameter indicates the type of synchronization messaging that has been provisioned for that OC-12 optical interface by the **`set-oc12`** command. The valid values for this parameter are `Kbyte` (default value), `Sbyte`, and `disabled`. The sync messages use the K2 byte or the S1 byte in the SONET line overhead to determine synchronization quality.

`AIS Alarm` This parameter specifies the alarm level of a non-service-affecting OC-12 line AIS failure condition. The valid values are

- **`cr`** Critical alarm
- **`mj`** Major alarm
- **`mn`** Minor alarm
- **`na`** Not alarmed, but reported (default)

RELATED COMMANDS

set-oc3

set-oc12

NAME

rtrv-osacmap: Retrieve Operation Systems Application Context Map

INPUT FORMAT

rtrv-osacmap;

DESCRIPTION

This command displays the Operation Systems Application Context Map information that is created by the **ent-osacmap** command. This information provides association information between OS application contexts and X.25 channel assignments.

NOTE:
While this command is allowed at all network elements in the subnetwork, only the table at a GNE node is active.

The output report appears as follows:

```
/* OS Application Context Map Report
============================================================
VC Type  SNPA Address      ACID
============================================================
pvc      1                tl1_application_context
pvc      2                tl1_application_context
pvc      3                tl1_application_context
svc      address          tl1_application_context
svc      address          tl1_application_context
svc      address          tl1_application_context
*/
```

The above report shows allocation of PVCs for LCNs 1, 2, and 3. The other SNPA addresses contain some allocated SVCs.

NOTE:
The above report is sorted by the VC Type, and then by SNPA within the VC Type parameters.

The output parameters are:

`VC Type` VCType is the X.25 SubNetwork Virtual Channel Type. The valid values are:

PVC Permanent Virtual Circuit

SVC Switched Virtual Circuit.

`SNPA Address`

SNPA Address is the X.25 SubNetwork Point of Attachment address for the OS. It is either the Logical Channel Number (LCN) if VCType is *PVC*, or it is the Data Terminal Equipment (DTE) calling address (which is 1 to 15) digits if VCType is *SVC*.

NOTE:
Up to nine VCs can be mapped to any combination of PVCs and/or SVCs (that is, the allocation of PVCs can be removed and replaced by SVCs).

`ACID` ACID is a string of up to 23 alphanumeric characters, which is the Application Context ID to be assigned to a particular SNPA Address. Each OS has a value of ACID assigned. Default values exist for OS applications supported by DDM-2000. The supported applications types are:

tl1Maintenance

tl1MemoryAdministration

tl1PeerComm

tl1Test

tl1CR

tl1Other1

tl1Other2.

When this command is entered at a node that is not an active GNE, the following caution message will be displayed before the report is printed:

```
/* Caution! This OS Application Context Map Report is not active.
            Only the map at a GNE is active. */
```

RELATED COMMANDS

ent-tl1msgmap

rtrv-tl1msgmap

ent-osacmap

dlt-osacmap

NAME

rtrv-passwd: Retrieve Passwords

INPUT FORMAT

`rtrv-passwd`;

DESCRIPTION

This command displays the logins, passwords (in encrypted form), and user type for all logins in the system. This command should *only* be used to back up this information to an external workstation.

Additional workstation software and the **`rstr-passwd`** command will be used to re-create this information on the network element when a new controller is installed.

NOTE:
This command is available to privileged users only.

The output report appears as follows:

```
/* Password Provisioning Report
============================================================
Login : Password : User Type :
============================================================
ATT01:08:sdfsdt-g:privileged:
ATT02:08:67&&8#1g:privileged:
ATT03:08:57s&8#1g:privileged:
DDM-2000:07:kdsm5:-:general:
george:09:RVoc6*bQ1:maintenance:
pete:08:RTnu8*bB:reports-only:
*/
```

The output parameters are:

`Login`	The login name established by the security administrator.
`Password`	The length and current encrypted password selected by the user of the login.
`User Type`	The access class assigned to this login by the security administrator.

RELATED COMMANDS

rstr-passwd

rtrv-lgn

set-lgn

set-passwd

NAME

rtrv-pm-line: Retrieve Performance Monitoring Line

INPUT FORMAT

rtrv-pm-line:*Address*;

DESCRIPTION

This command displays performance-monitoring data associated with the OC-3, OC-12, or EC-1 lines terminated on the system.

NOTE:
If Main slots 1 and 2 are equipped with different pack types (for example, during an upgrade), the output report for this command will include data for what is considered at the time as the valid system pack type.

The input parameters are:

Address Address of the OC-3, OC-12, or EC-1 lines.
Valid OC-12 Line Addresses: **main-b-{1,2,all}**
Valid OC-3 Line Addresses: **fn-{a,b,c,d,all}-{1,2,all}**
Valid EC-1 Line Addresses: **{a,b,c,d,all}-{1-3,all}**

The output report appears as follows:

```
/* Line Performance Monitoring Status Report
   Last initialized:  day registers at yy-mm-dd hh:mm:ss
                      quarter hour registers at yy-mm-dd hh:mm:ss
================================================================================
Address  Start   B2 CV   B2 ES   B2 ES    B2 ES   B2 SES   B2 UAS   PSC-L
         Time                    Type A   Type B
================================================================================
address   time    nn...   nn...    nn...    nn...   nn...    nn...   nn...
   .       .        .       .        .        .       .        .       .
   .       .        .       .        .        .       .        .       .
--------------------------------------------------------------------------------
address   time    nn...   nn...    nn...    nn...   nn...    nn...   nn...
   .       .        .       .        .        .       .        .       .
   .       .        .       .        .        .       .        .       .
```

The output parameters are:

`Address` This column shows the address of the monitored signal.

`Start Time` This column indicates the time on the system clock when the data collection started.

B2 CV	This parameter shows the number of coding violations for the data collection interval that started at the time reported in the previous column.
B2 ES	This parameter shows the number of errored seconds in the data collection interval.
B2 SES	This parameter shows the number of severely errored seconds.
B2 ESA	This parameter shows the number of Type A errored seconds in the data collection interval. A Type A errored second is a second with a single error.
B2 ESB	This parameter shows the number of Type B errored seconds in the data collection interval. A Type B errored second is a second with more than one error but less than the number of errors in a severely errored second. An OC-12 severely errored second contains 124 or more errors. An EC-1 severely errored second contains 12 or more errors.
B2 UAS	This parameter shows the number of unavailable seconds.
PSC-L	This parameter shows the number of protection switches from this line. This parameter does not apply to EC-1 lines.

NOTE:
Rows that are all zeros are not printed, except for the current day and current quarter, which are always printed.

A greater-than symbol (>) following a count indicates that the register has overflowed and that the indicated count is the register maximum.

A hyphen (-) indicates that the count for that parameter is not available due to a trouble condition.

A blank indicates that the report field does not apply.

A question mark (?) following a count indicates that the count includes data for less than the full counting interval. This may occur if a **reset** or **set-date** command is entered into the system or if the OLIU/EC-1 circuit pack is inserted or removed. If the count is both overflowed and incomplete, only the greater-than symbol (>) appears.

An asterisk (*) following a count for a parameter indicates that a threshold crossing has occurred for that parameter.

RELATED COMMANDS

init-pm

rtrv-pm-sect

rtrv-pm-tca

rtrv-pmthres-line

set-pmthres-line

NAME

rtrv-pm-sect: Retrieve Performance Monitoring Section

INPUT FORMAT

rtrv-pm-sect:*Address*;

DESCRIPTION

This command displays performance-monitoring data associated with the OC-1, OC-3 and OC-12 optics and the STS-3 and STS-12 section.

NOTE:
If slots 1 and 2 are equipped with different pack types (for example, during an upgrade), the report will include data for what is considered at the time as the valid system pack type.

The input parameter is:

Address Address of the OC-3 or OC-12 line(s). The address **all** may be used to retrieve all performance-monitoring information.

Valid OC-12 Line Addresses: **main-b-{1,2,all}**
Valid OC-3 Line Addresses: **fn-{a,b,c,d,all}-{1,2,all}**

The output report appears as follows:

```
/* Optics and Section Performance Monitoring Status Report
   Last initialized:  day registers at yy-mm-dd hh:mm:ss
                      quarter hour registers at yy-mm-dd hh:mm:ss
================================================================
Address  Start  Transmit  Transmit  Laser   SEFS
         Time   Pwr -1dB  Pwr -2dB  Bias
                  TCA       TCA      TCA
================================================================
address  time     aaa       aaa     aaa     nnn
   .      .        .         .       .       .
   .      .        .         .       .       .
----------------------------------------------------------------
address  time     aaa       aaa     aaa     nnn
   .      .        .         .       .       .
   .      .        .         .       .       .
   */
```

The output parameters are:

`Address`	This indicates the address of the OC-3 or OC-12 line.
`Start Time`	This indicates the time on the system clock when the data collection started.
`Transmit Power -1dB`	This column shows whether a -1 dB transmit power threshold crossing has occurred in the data collection interval starting at the time reported in the previous column. This parameter applies only to the 21G OLIU circuit pack, and has a value of **`yes`** or **no**.
`Transmit Power -2dB`	This column shows whether a -2 dB transmit power threshold crossing has occurred in the data collection interval starting at the time reported in the previous column. This parameter applies only to the 21G OLIU circuit pack, and has a value of **`yes`** or **no**.
`Laser Bias`	This column indicates the TCA of the OLIU laser bias threshold setting. This parameter applies only to the 21G, 23G, 23H and 23R OLIU circuit packs.
`SEFS`	This column displays the number of severely errored frame seconds.

NOTE:
Rows that are all zeros or "no's" are not printed except for current day and current quarter hour, which are always printed.

A greater-than symbol (>) following a count indicates that the register has overflowed and that the indicated count is the register maximum.

A hyphen (-) indicates that the count for that parameter is not available due to a trouble condition or the parameter is not applicable for current equipage.

A blank indicates that the report field does not apply.

A question mark (?) following a count indicates that the count includes data for less than the full counting interval. This may occur if a **`reset`** or **`set-date`** command is entered into the system or if the OLIU circuit pack is inserted or removed. If the count is both overflowed and incomplete, only the greater-than symbol (>) appears.

An asterisk (*) following a count for a parameter indicates that a threshold crossing has occurred for that parameter.

RELATED COMMANDS

init-pm

rtrv-pm-line

rtrv-pm-tca

rtrv-pmthres-sect

set-pmthres-sect

NAME

rtrv-pm-sts1: Retrieve Performance Monitoring STS-1

INPUT FORMAT

rtrv-pm-sts1:*Address*;

DESCRIPTION

This command reports path performance-monitoring data associated with STS-1 signals terminating on the network element. For most STS-1 cross-connected paths, data is collected on the active path of the signals and only the active path is reported. For STS-1 cross-connections, path termination exists if one of the interfaces is not SONET (for example, a BBG4B DS3 interface).

The input parameter is:

Address This parameter identifies the address of STS-1 channels. It is the address of the incoming STS-1 signal before it is cross-connected.

Valid Ring Addresses:
all, mb-{1-12,all} (to OLIU from 3DS3)

The address "**mb**" is the active path just as "**m-b**" in linear systems is the active path.

The output report appears as follows:

```
/* STS-1 Path Performance Monitoring Status Report
   Last initialized:  day registers at yy-mm-dd hh:mm:ss
                      quarter hour registers at yy-mm-dd hh:mm:ss
=====================================================================
Address  Start   B3 CV    B3 ES  B3 ES   B3 ES   B3 SES  B3 UAS
         Time                   Type A  Type B
=====================================================================
address   time   nn...   nn...   nn...    nn...    nn...   nn...
   .       .       .       .       .        .        .       .
   .       .       .       .       .        .        .       .
---------------------------------------------------------------------
address   time   nn...   nn...   nn...    nn...    nn...   nn...
   .       .       .       .       .        .        .       .
   .       .       .       .       .        .        .       .
*/
```

The output parameters are:

`Address`	This column shows the address of the monitored signal.
`Start Time`	This column indicates the time on the system clock when the data collection started.
`B3 CV`	This column shows the number of coding violations.
`B3 ES`	This column shows the number of errored seconds.
`B3 ES Type A`	This column shows the number of Type A errored seconds. A Type A errored second is a second with a single error.
`B3 ES Type B`	This column shows the number of Type B errored seconds. A Type B errored second is a second with more than one error but less than the number of errors in a severely errored second.
`B3 SES`	This column shows the number of severely errored seconds. A severely errored second contains 9 or more errors.
`B3 UAS`	This column shows the number of unavailable seconds of service. A count of unavailable seconds begins after 10 consecutive severely errored seconds has occurred.

NOTE:
Rows that are all zeros are not printed except for current day and current quarter hour, which are always printed.

A greater-than symbol (>) following a count indicates that the register has overflowed and that the indicated count is the register maximum.

A hyphen (-) indicates that the count for that parameter is not available due to a trouble condition.

A blank indicates that the report field does not apply.

A question mark (?) following a count indicates that the count includes data for less than the full counting interval. This may occur if a **`reset`** or **`set-date`** command is entered into the system or if the DS3, EC1, OLIU circuit pack is inserted or removed. If the count is both overflowed and incomplete, only the greater-than symbol (>) appears.

An asterisk (*) following a count for a parameter indicates that a threshold crossing has occurred for that parameter.

RELATED COMMANDS

init-pm

rtrv-pm-tca

rtrv-pmthres-sts1

set-pmthres-sts1

NAME

rtrv-pm-t3: Retrieve Performance Monitoring T3

INPUT FORMAT

rtrv-pm-t3:*Address*;

DESCRIPTION

This command displays performance-monitoring data associated with one or more DS3 signals passing through the system. This report is enhanced to display the performance monitoring data for the DS3 line and path incoming from the DSX-3, in addition to the previously displayed data for the DS3 path incoming from the fiber.

The line and path PM data from the DSX-3, as well as all near-end and far-end C-bit parity PM data are available ONLY when a BBG11B pack is active (in-service) in a function unit slot. When a function unit slot is equipped with one of these new circuit packs, the DS3 line performance monitoring data will always be displayed regardless of what type of mode the DS3 service has been provisioned for. If the *clear channel (cc)* mode is selected, the report will display the DS3 line PM data and dash lines (-) for both directions of all DS3 path PM data.

NOTE:
For the TMUX (BBG20) circuit pack in OC-3 Release 13.0 and later, only the line and path on the incoming signal from the DSX-3 is monitored. The mode parameter of the **set-t3** command is NOT applicable to this circuit pack. The report will always display blank lines for the DS3 data incoming from the fiber for this pack.

The input parameters are:

Address Address of the DS3 signal(s).
Valid DS3 Port Addresses: **all, {a,b,c,d}-{1-3,all}**

The output report appears as follows:

```
/* DS3 Performance Monitoring Status Report
   Last initialized:  day registers at yy-mm-dd hh:mm:ss
                      quarter hour registers at yy-mm-dd hh:mm:ss
================================================================================
Address  Type       Start   SEFS        CV       ES     SES     UAS
         Direction  Time
================================================================================
address  line       time                n        n      n
         dsx-p                  n       n        n      n       n
         dsx-pfe                n       n        n      n       n
address  fiber-p                n       n        n      n       n
         fiber-pfe              n       n        n      n       n
   */
```

The output parameters are:

`Address` This shows the address of the DS3 signal incoming from the DSX-3 or the fiber.

`Type Direction`
This shows the type of the PM data (line, path, path far-end) and the direction from which the signal is received (dsx-3 or fiber).

`Start Time` This indicates the time on the system clock when the data collection started. The parameters are reported as a combination of their type and direction from which they are received. For *`line`* parameters, refer to CV-L, ES-L, and SES-L definitions. For *`dsx-p`* and *`fiber-p`* parameters, see SEFS, CV-P, ES-P, SES-P, and UAS-P definitions. For far-end *`dsx-pfe`* and *`fiber-pfe`* path parameters, refer to SEFS, CV-PFE, ES-PFE, SES-PFE, and UAS-PFE definitions.

`CV-L` This indicates the number of B3ZS coding violations occurring over the accumulation period for the DS3 signal incoming from the DSX-3.

`ES-L` This indicates the number of seconds with at least one B3ZS coding violation or LOS for the DS3 signal incoming from the DSX-3.

`SES-L` This indicates the number of seconds with greater than 44 B3ZS coding violations or LOS for the DS3 signal incoming from the DSX-3.

`SEFS` This indicates the number of out of frame seconds or AIS seconds for the DS3 signal incoming from the DSX-3 or the fiber.

CV-P	This shows the number of P-bit, adjusted F&M bit, or C-bit parity coding violations for the DS3 signal incoming from the DSX-3 or the fiber.
ES-P	This shows the number of path errored seconds for the DS3 signal incoming from the DSX-3 or the fiber.
SES-P	This shows the number of path severely errored seconds for the DS3 signal incoming from the DSX-3 or the fiber. A severely errored second contains 44 or more errors.
UAS-P	This shows the number of path unavailable seconds of service for the DS3 signal incoming from the DSX-3 or the fiber. A count of unavailable seconds begins after 10 consecutive severely errored seconds has occurred.
CV-PFE	This shows the number of FEBE bits path coding violations at the far-end for a C-bit framed DS3 service that has been provisioned for cbit frame and cpbit format using the **set-t3** command. This applies to a DS3 signal incoming from the DSX-3 or the fiber.
ES-PFE	This shows the number of far-end path errored seconds for a C-bit framed DS3 service that has been provisioned for cbit frame and cpbit format using the **set-t3** command. This applies to a DS3 signal incoming from the DSX-3 or the fiber.
SES-PFE	This shows the number of far-end path severely errored seconds for a C-bit framed DS3 service that has been provisioned for cbit frame and cpbit format using the **set-t3** command. This applies to a DS3 signal incoming from the DSX-3 or the fiber. A severely errored second contains 44 or more errors.
UAS-PFE	This shows the number of far-end path unavailable seconds for a C-bit framed DS3 service that has been provisioned for cbit frame and cpbit format using the **set-t3** command. This applies to a DS3 signal incoming from the DSX-3 or the fiber. A count of unavailable seconds begins after 10 consecutive severely errored seconds has occurred.

NOTE:
Rows that are all zeros are not printed except for current day and current quarter, which are always printed.

A greater-than symbol (>) following a count indicates that the register has overflowed and that the indicated count is the register maximum.

A hyphen (-) indicates that the count for that parameter is not available due to a trouble condition.

A blank indicates that the report field does not apply.

A question mark (?) following a count indicates that the count includes data for less than the full counting interval. This may occur if a **`reset`** or **`set-date`** command is entered into the system or if the DS3 and/or TMUX circuit pack is inserted or removed, or a terminal or a facility loopback is established. (For the TMUX, establishing a DS3 facility loopback will not interrupt the collection of the line and path PMON data). If the count is both overflowed and incomplete, only the greater-than symbol (>) appears.

An asterisk (*) following a count for a parameter indicates that a threshold crossing has occurred for that parameter.

RELATED COMMANDS

init-pm

rtrv-pm-tca

rtrv-pmthres-t3

set-pmthres-t3

set-t3

NAME

rtrv-pm-tca: Retrieve Performance Monitoring TCA

INPUT FORMAT

`rtrv-pm-tca`;

DESCRIPTION

This command displays the number of threshold crossing alerts (TCAs) associated with signals terminating in or passing through the system. A TCA occurs when a performance-monitoring counter exceeds a user-selected threshold.

NOTE:
If slots 1 and 2 are equipped with different pack types (for example, during an upgrade), the output report for this command will include data for what is considered at the time as the valid system pack type.

The output report appears as follows:

```
/* TCA Performance Monitoring Summary Report
=============================================================================
Address   Optics  Section   Line   STS-1    DS3    DS3
                                   Path     Path   Line
=============================================================================
address     n        n       n
address     n        n       n
address                              n
address                              n        n      n
address                              n        n
```

The output report shows the address and type of parameters that are generating TCAs. Blanks in the report indicate that the output parameter does not apply for the specified address.

The output parameters are:

`Address` Address of the monitored signal. This can be the address of an OC-3 or OC-12 line, STS-1 channel, EC-1 port or DS3 port.

`Optics` This shows the total number of TCAs associated with optical performance-monitoring parameters (Transmit Pwr -1dB, Transmit Pwr -2dB, Laser Bias).

`Section`	This shows the total number of TCAs associated with section performance monitoring parameters (severely errored frame seconds).
`Line`	This shows the total number of TCAs associated with line performance monitoring parameters (B2 CV, B2 ES, B2 ES Type A, B2 ES Type B, B2 SES, B2 UAS, PSC, or PJC).
`STS-1 Path`	This shows the total number of TCAs associated with STS-1 path performance monitoring parameters (B3 CV, B3 ES, B3 ES Type A, B3 ES Type B, B3 SES, or B3 UAS). Starting with OC-3 Release 13.0, independent TCA counts are reported for each of the two STS-1 channels, one from each ring, cross-connected to the BBG21 ELAN circuit pack(s) in a function unit with addresses m1-x and m2-x. Also starting with this release, all non-terminated STS cross-connected services at both ring OLIU, non-ring OLIU, and EC-1 interfaces will be monitored and reported. For the ring OLIU interfaces, independent TCA counts are reported for each of the two STS-1 channels, one from each ring. For the non-ring OLIU and EC-1 interfaces, only TCA counts of the active interface is reported.
`DS3`	This shows the total number of TCAs associated with DS3 path performance monitoring parameters (severely errored frame seconds, P-bit, adjusted F&M bit, or C-bit parity CV-P, ES-P, SES-P, UAS-P) incoming from the fiber and the DSX-3. The report will also show the total number of TCAs for DS3 line performance monitoring parameters (CV-L, ES-L, SES-L). For ports on the BBG11B Starting with OC-3 Release 13.0, only the TCAs for the DS3 signal incoming from the DSX-3 are applicable to the TMUX (BBG20) circuit packs.

RELATED COMMANDS

init-pm

rtrv-pm-line

rtrv-pm-sect

rtrv-pm-t3

set-pmthres-line

set-pmthres-sect

set-pmthres-t3

NAME

rtrv-pmthres-line: Retrieve Performance Monitoring Threshold Line

INPUT FORMAT

`rtrv-pmthres-line`;

DESCRIPTION

This command displays the system's current OC-3 and OC-12 line performance parameter thresholds, as set by the **`set-pmthres-line`** command.

NOTE:
If slots 1 and 2 are equipped with different pack types (for example, during an upgrade), this report will include data for what is considered at the time as the valid system pack type.

The output report appears as follows:

```
/* Line Performance Monitoring Thresholds Report
============================================================
Parameter                                    Thresholds
                                          Quarter    Day
                                           Hour
============================================================
B2 Coding Violations OC12 (B2CVOC12)        n         n
B2 Coding Violations OC3 (B2CVOC3)          n         n
B2 Coding Violations EC1 (B2CVEC1)          n         n
B2 Errored Seconds (B2ES)                   n         n
B2 Errored Seconds Type A (B2ESA)           n         n
B2 Errored Seconds Type B (B2ESB)           n         n
B2 Severely Errored Seconds (B2SES)         n         n
B2 Unavailable Seconds (B2UAS)              n         n
Line Protection Switch Counts (PSCL)        n         n
STS Pointer Justification Counts (PJC)      n         n
*/
```

The first column of the report contains the names of the line performance monitoring parameters. The second and third columns contain the quarter hour and day thresholds for each parameter. The output parameters are:

`B2 Coding Violations OC12` — This parameter displays the threshold values for the B2 coding violation counts for OC-12 lines.

`B2 Coding Violations OC3` — This parameter displays the threshold values for the B2 coding violation counts for OC-3 lines.

`B2 Coding Violations EC1`	This parameter displays the threshold values for the B2 coding violation counts for EC-1 lines.
`B2 Errored Seconds`	This parameter displays the threshold values for the B2ES count.
`B2 Errored Seconds Type A`	This parameter displays the threshold values for the B2ESA count.
`B2 Errored Seconds Type B`	This parameter displays the threshold values for the B2ESB count.
`B2 Severely Errored Seconds`	This parameter displays the threshold values for the B2SES count.
`B2 Unavailable Seconds`	This parameter displays the threshold values for the B2UAS count.
`Line Protection Switch Count`	This parameter displays the threshold values for the line protection switch count.
`STS Pointer Justification Count`	This parameter displays the threshold values for the STS pointer justification count. This parameter is available with Release 11.0 and later.

A parameter threshold of zero indicates that thresholding is disabled.

A negative threshold value indicates that the coding violation threshold is specified in terms of an equivalent bit error ratio (BER) of 10^{-n}.

RELATED COMMANDS

init-pm

rtrv-pm-line

rtrv-pm-tca

set-pmthres-line

NAME

rtrv-pmthres-sect: Retrieve Performance Monitoring Threshold Section

INPUT FORMAT

rtrv-pmthres-sect;

DESCRIPTION

This command displays the system's current section performance parameter thresholds, as set by the **set-pmthres-sect** command.

The output report appears as follows:

```
/* Optics and Section Performance Monitoring Thresholds Report
================================================================
Transmit Power 1dB (TxPwr1dB) = x
Transmit Power 2dB (TxPwr2dB) = x
Laser Bias = x
================================================================
Parameter                                  Thresholds
                                        Quarter    Day
                                         Hour
================================================================
Severely Errored Frame Seconds (SEFS)    n          n
*/
```

Values for the first three output parameters are **enabled** and **disabled**. The output parameters are:

`Transmit Power 1dB` OLIU transmit power threshold setting. This parameter applies only to the 21G OLIU circuit pack.

`Transmit Power 2dB` OLIU transmit power threshold setting. This parameter applies only to the 21G OLIU circuit pack.

`Laser Bias` OLIU laser bias threshold setting. This parameter applies only to the 21G, 23G, 23H and 23R OLIU circuit packs.

`Severely Errored Frame Seconds` This parameter displays the threshold values for the SEFS count. A parameter threshold of zero indicates that the thresholding is disabled.

RELATED COMMANDS

init-pm

rtrv-pm-sect

rtrv-pm-tca

set-pmthres-sect

NAME

rtrv-pmthres-sts1: Retrieve Performance Monitoring Threshold STS-1

INPUT FORMAT

`rtrv-pmthres-sts1`;

DESCRIPTION

This command retrieves the system's STS-1 path performance monitoring thresholds, as set by the **`set-pmthres-sts1`** command.

The output report appears as follows:

```
/* STS-1 Path Performance Monitoring Thresholds Report
================================================================
Parameter                                    Thresholds
                                          Quarter        Day
                                           Hour
================================================================
B3 Code Violations (B3CV)                    n             n
B3 Errored Seconds (B3ES)                    n             n
B3 Errored Seconds Type A (B3ESA)            n             n
B3 Errored Seconds Type B (B3ESB)            n             n
B3 Severely Errored Seconds (B3SES)          n             n
B3 Unavailable Seconds (B3UAS)               n             n
*/
```

The first column of the report contains the names of the path performance monitoring parameters. The second and third columns contain the quarter-hour and day thresholds for each parameter. The output parameters are:

`Quarter Hour` This column contains the quarter-hour thresholds for each performance monitoring parameter.

`Day` This column contains the day thresholds for each performance-monitoring parameter.

`B3CV` This parameter shows the threshold for coding violations. A negative threshold value indicates that the coding violation threshold is specified in terms of an equivalent Bit Error Ratio (BER) of 10^{n}. A threshold of zero indicates that the thresholding is disabled.

`B3ES` This parameter shows the threshold for errored seconds.

`B3ESA` This parameter shows the threshold for type A errored seconds.

B3ESB	This parameter shows the threshold for type B errored seconds.
B3SES	This parameter shows the threshold for the number of severely errored seconds.
B3UAS	This parameter shows the threshold for unavailable seconds of service.

RELATED COMMANDS

init-pm

set-pmthres-sts1

rtrv-pm-sts1

rtrv-pm-tca

NAME

rtrv-pmthres-t3: Retrieve Performance Monitoring Threshold T3

INPUT FORMAT

`rtrv-pmthres-t3`;

DESCRIPTION

This command displays the system's current DS3 performance parameter thresholds, as set by the **`set-pmthres-t3`** command.

The output report appears as follows:

NOTE:
All DS3 line parameters, in addition to DS3 C-bit parity and all other path parameters for the incoming signal from the DSX-3, are only applicable when a BBG11B pack is active (in-service) in a function unit slot.

```
/* DS3 Performance Monitoring Thresholds Report
=============================================================================
   Parameter                                          Thresholds
                                                  Quarter      Day
                                                    Hour
=============================================================================
 Coding Violations-Line (CVL)                        n          n
 Errored Seconds-Line (ESL)                          n          n
 Severely Errored Seconds-Line (SESL)                n          n
 Severely Errored Frame Seconds (SEFS)               n          n
 P-bit Coding Violations-Path (PCV)                  n          n
 F&M bit Coding Violations-Path (FMCV)               n          n
 C-bit Coding Violations-Path (CP)                   n          n
 Errored Seconds-Path (ESP)                          n          n
 Severely Errored Seconds-Path (SESP)                n          n
 Unavailable Seconds-Path (UASP)                     n          n
 Severely Errored Frame Seconds-Far End (SEFSFE)     n          n
 C-bit Coding Violations-Path Far End (CPFE)         n          n
 Errored Seconds-Path Far End (ESPFE)                n          n
 Severely Errored Seconds-Path Far End (SESPFE)      n          n
 Unavailable Seconds-Path Far End (UASPFE)           n          n
 */
```

A threshold of zero indicates that thresholding is disabled.

The output parameters are:

CVL These parameters display the threshold for the coding violations count of the DS3 line B3ZS data. A negative value for this parameter indicates that the threshold is specified in terms of an equivalent bit error ratio (BER) of 10^n.

ESL These parameters display the threshold for the errored seconds count of the DS3 line with at least one B3ZS coding violation.

SESL These parameters display the threshold for the severely errored seconds count of the DS3 line with greater than 44 B3ZS coding violations.

SEFS These parameters display the threshold values for severely errored frame seconds. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber.

PCV These parameters display the threshold for the DS3 P-bit coding violation counts. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. A negative threshold value indicates that the coding violation threshold is specified in terms of an equivalent BER of 10^n.

FMCV These parameters display the threshold for the DS3 F&M bit coding violation counts. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. A negative threshold value indicates that the coding violation threshold is specified in terms of an equivalent BER of 10^n.

CP These parameters display the threshold for the DS3 C-bit coding violation counts. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. A negative threshold value indicates that the coding violation threshold is specified in terms of an equivalent BER of 10^n.

ESP These parameters display the threshold for the DS3 P-bit, adjusted F&M bit, or C-bit errored seconds counts. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber.

SESP These parameters display the threshold for the DS3 P-bit, adjusted F&M bit, or C-bit severely errored seconds counts. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber.

UASP These parameters display the threshold for the DS3 P-bit, adjusted F&M bit, or C-bit unavailable seconds counts. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber.

SEFSFE These parameters display the threshold values for the far-end DS3 C-bit severely errored frame seconds. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber.

CPFE These parameters display the threshold for the DS3 far-end C-bit coding violation counts. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. A negative threshold value indicates that the coding violation threshold is specified in terms of an equivalent BER of 10^{n}.

ESPFE These parameters display the threshold for the DS3 far-end C-bit errored seconds counts. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber.

SESPFE These parameters display the threshold for the DS3 far-end C-bit severely errored seconds counts. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber.

UASPFE These parameters display the threshold for the DS3 far-end C-bit unavailable seconds counts. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber.

RELATED COMMANDS

init-pm

rtrv-pm-t3

rtrv-pm-tca

set-pmthres-t3

set-t3

NAME

rtrv-secu: Retrieve Security

INPUT FORMAT

rtrv-secu;

DESCRIPTION

This command retrieves CIT and DCC ports security and timeout information.

Starting with OC-12 Release 7.0, this command will also report on the users who are currently logged into the Network Element via the CIT, and DCC ports.

This command will report also on the users logged in to the NE via the X.25 PVCs and/or SVCs (**only** if local NE is a GNE). This X.25 section of the report will be displayed (in the TL1 section of the report) after the CIT and DCC information.

For OC-12 Release 7.0 and later OC-12 releases, the output report appears as follows:

```
/* Port Security Configuration Report
================================================================
Access       Security       Timeout,       Active
Link                        minutes        User
================================================================
cit-1        lockout         0             LUC01
cit-2        enabled        60             -
dcc          lockout        15             LUC03
----------------------------------------------------------------
TL1
___
Access       SNPA                          Active
Link                                       User
----------------------------------------------------------------
dcc                                        user1
x25(PVC)     1                             user7
x25(PVC)     2                             user8
x25(PVC)     3                             user9
x25(SVC)     146782229996                  user10
*/
```

The output parameters are:

`Access Link` Access link is the address of a CIT or DCC interface. Valid Addresses: **`dcc, cit-{1,2}`**

`Security` Security shows whether security is enabled, disabled, or in lockout state on the listed CIT or DCC port. The valid values are `enabled`, `disabled`, or `lockout`. When security is enabled, a user must enter a valid login and password to begin a session. When security is in `lockout` state, only a `privileged` user is permitted to access the system through the locked out CIT/DCC ports.

`Timeout` This parameter shows the time duration, in minutes, before an inactive session is terminated on a specified CIT or DCC interface. If timeout is zero (0), then there is no timeout.

`Active User` This parameter is available starting with OC-12 Release 7.0. This parameter reports on the user's login id that is currently logged into the NE via the communication port identified by the *`Address`* column. If no user is currently logged in at the time of the report, this parameter is reported as a dash ("-").

`TL1` This parameter is available starting with OC-12 Release 7.0. This section of the report will list the users logged in to the NE via the X.25 PVCs and/or SVCs (**`only if local NE is a GNE`**) or TL1 dcc and it is sorted by TL1 dcc first, the VC type (PVC and then SVC) and then by SNPA. This X.25 section of the report is displayed after the CIT, DCC and TL1 DCC information and it includes the following columns:

`Access Link`
This parameter is available starting with OC-12 Release 7.0. Access link is the address of a TL1 interface. Valid TL1 Interface Addresses: **`dcc`**, **`x25(PVC), x25(SVC)`** (OC-12 Release 7.0 and later OC-12 releases)

SNPA This parameter is available starting with OC-12 Release 7.0. Contains the X.25 Subnetwork Point of Attachment address for the OS. It is either the PVC Logical Channel Number (LCN) or the SVC Data Terminal Equipment (DTE) calling address, which is 1 to 15 digits. Up to nine VCs can be mapped to any combination of PVCs and SVCs.

`Active User`

This parameter is available starting with OC-12 Release 7.0. This parameter reports on the user's login id that is currently logged into the NE via the communication port identified by the *`Address`* column. If no user is currently logged in at the time of the report, this parameter is reported as a dash (—).

RELATED COMMANDS

rtrv-lgn

set-secu

NAME

rtrv-state-eqpt: Retrieve State Equipment

INPUT FORMAT

rtrv-state-eqpt[:*Address*];

DESCRIPTION

This command displays slot, port, and protection switching state information for the network element (NE).

NOTE:
If slots 1 and 2 are equipped with different pack types (for example, during an upgrade), the report will include data for what is considered at the time as the valid system pack type.

The input parameter is:

Address Address identifies one or more slots. The default is **all** for all slots in the system.

Valid OC-12 Addresses: **all, main-b-{1,2,all}, fn-all, fn-{a,b,c,d}-{1,2,all}, tsi-{1,2,all}, tg-{1,2,all}**

The output report appears on the following page.

```
/* Equipment State Report
   ============================================================
   Address   Circuit    Port     Switch     Switch
              Pack    State(s)   State     Priority
   ============================================================
   address    pack       p         s       priority
   address    pack       p         s       priority
     .         .         .         .          .
     .         .         .         .          .
   ------------------------------------------------------------
   address    pack       p         s       priority
     .         .         .         .          .
     .         .         .         .          .
   address    pack       p         s       priority
*/
```

In the output report, slot types are separated by a row of dashes. Within each slot type, slots are listed in order of their addresses, with protection slots listed last. Slots for control circuit packs (SYSCTL, AUXCTL) are not listed in this

report.

The output parameters are:

`Address` Address is the address of a slot.

`Circuit Pack`
Circuit pack is the circuit pack name. A hyphen (-) means not applicable or not equipped.

`Port State(s)`
The state of the signal, from the DS-3 or EC-1 signals, is reported.

Port State (p) may be blank or have one of the following values:

`i` (In-Service) In this state, the port is monitored for failures, and the appropriate alarm is generated if a failure is detected. To retire the alarm and transition the associated port to the `auto` state, the update function must be performed after the input signal is removed.

a (Automatic) In this state, the port will automatically be put `in-service` if a good signal is detected. This state is not allowed for OC-N signals.

n (Not Monitored)
In this state, the signal is not monitored or alarmed. The port will not automatically go to the `in-service` state when a signal is detected.

— Not applicable (not equipped).

The port state is always blank for timing circuits, for protection slots for 1x1 and 1xn protected circuit packs, and for OLIU circuit packs. Note that the BBG19 DS3 circuit pack is 0x1 protected and thus has independent port states for the service and protection slots. The port state is always blank for both OLIU circuit packs in function units provisioned for the 0x1 ring, video and 1+1 applications.

`Switch State`
This indicates whether the circuit pack is active or standby, corresponding to the state of the protection switching relays. Switch state(s) may be one of the following:

`active` For OC-N lines in a 1+1 line-protected configuration, active means the signal being received on this line is selected by the near end protection switch and the signal being transmitted on this line is selected by the far end. For ring applications, each OLIU in the main-b slots and the TSI in the tsi slots is feeding its ring channels incoming from the fiber to the other side for pass-through connections and is sending drop channels to the function units. Some or all of the

received ring channels incoming from this OLIU may be active. This can be determined using the **rtrv-state-path** command on this system. Some or all of the transmitted ring channels outgoing to the fiber may also be active. This can be determined by using the **rtrv-state-path** command on *all* remote systems.

`active-fn` For a TSI slot in ring applications, this means that the ring path protection switching is currently being done on this pack, and this pack is choosing each active ring channel from either ring and sending it to the function units.

For other pack types, active means the signal is being transmitted and received from this pack. Even if the pack is removed, the slot will remain active unless there is a protection circuit pack that service can be switched to.

`active-tx` For the function unit's OC-3 lines, the signal being transmitted is selected by the far end, but the received signal is not selected by the near end protection switch.

`active-rx` For the function unit's OC-3 lines, the signal being received on this line is selected by the near end protection switch, but the signal being transmitted is not selected by the far end.

`active-?` For the function unit's OC-3 lines, the protection line is failed in the receive direction. The state of the protection line in the transmit direction is unknown; the signal transmitted on the protection line *might* be selected by the far end.

`standby` The circuit pack or optical line is not currently active.

— Not applicable or not equipped.

For ring applications because of pass-through connections, the switch state will always be active for both main-b OLIUs and TSIs. For function units provisioned for pass-through, path-protected hairpin local drop, or 0x1 ring or video applications, the switch state will always be active for both OLIUs.

`Switch Priority`

Switch priority is the currently active protection switch request. Only a higher priority protection switch request can cause a protection switch to be done. For ring applications, the switch priority in this report applies only to the equipment switching of the main to function unit signals. See the **rtrv-state-path** command for

path protection switching information.

NOTE:
For 1X1 or 1+1 protected packs, the Switch Priority is displayed for both packs; The Switch Priority displayed for one pack is displayed for the other.

Switch priority may be one of the following:

`inhibit` No protection switches will be done until the switch is reset.

`lockout of protection`
This prevents access to the protection pack for the group.

`lockout of service`
This prevents access to the protection circuit pack for the specified service slot.

`forced` No automatic or manual switches will be done until the forced switch is reset.

`K1/K2 byte failure`
This occurs when the system cannot determine the protection switching state of the far end due to a failure of the automatic protection switching channel (K1/K2 bytes of the SONET line overhead on the protection line).

`APS-protection line signal failure`
Automatic protection switching has occurred due to a protection line signal failure.

`APS-service line signal failure`
Automatic protection switching has occurred due to a service line signal failure.

`APS-signal failure`
Automatic protection switching has occurred due to a signal failure.

`APS-signal degrade`
Automatic protection switching has occurred due to a signal degrade.

`APS-pack failure`
Automatic protection switching has occurred due to a circuit pack failure.

`APS-automatic lock`
Traffic is forced and held onto the protection pack, unable to revert to the service pack until midnight.

This occurs following four automatic switches from service to protection during a 10-minute interval.

`APS-wait to restore`
: Automatic protection switching has occurred, but the service line is now good and service will revert back to its original source after a specified period of time.

`manual`
: Traffic has been manually switched to protection.

—
: No manual or automatic switch requests are active.

For ring applications, the switch priority in this report applies only to the equipment switching of the TSIs to function unit signals. See the **`rtrv-state-path`** command for path protection switching information. The switch priority is always blank for protection slots.

The state of the timing reference is reported in the **rtrv-sync** command.

RELATED COMMANDS

rtrv-alm

rtrv-state-path (Rings only)

rtrv-sync

set-state-t3

switch-fn

switch-line

switch-sync

upd

NAME

rtrv-state-oc3: Retrieve state of OC-3 lines.

INPUT FORMAT

rtrv-state-oc3[:*Address*];

DESCRIPTION

This command retrieves OC-3 line states.

The input parameter is:

Address Address is the address of the OC-3 lines whose state is to be reported. The default is **all** OC-3 lines. Other valid addresses are:
fn-all, fn-{a,b,c,d}-{1,2,all}

The output report appears as follows. Only lines that are equipped with OC-3 type OLIU circuit packs will be displayed in the output report.

```
/* OC-3 Line State Report
================================================================
Address     Line State
================================================================
fn-a-2      nmon
fn-b-2      is
fn-c-1      nmon
fn-c-2      is
fn-d-2      is
*/
```

The output parameters are:

`Address` Address is the address of an OC-3 line.

`Line State` Line State is the state of the OC-3 line identified in the address field. It may have one of the following values:

- `is` In Service. The line is monitored. Alarm, status conditions, and PMON data are reported normally.
- `nmon` Not Monitored. Alarm or status conditions for the line are not reported. Section and line performance monitoring data collection will be stopped in this state. The line state will not change to "in service" if a good signal is detected. The line will remain in this state until the state is changed again with this command.

RELATED COMMANDS

rtrv-state-eqpt

set-state-oc3

set-oc3

rtrv-oc3

NAME

rtrv-state-path: Retrieve State Path

INPUT FORMAT

rtrv-state-path[:*Address*];

DESCRIPTION

This command displays signal path state information for path-protected signals dropped at the network element (NE). To determine which of the transmitted ring channels outgoing to the fiber are active, it may be necessary to also use the **rtrv-state-eqpt** command on all remote systems.

Any application that is path protected is reported.

NOTE:
If slots 1 and 2 are equipped with different pack types (for example, during an upgrade), the report will include data for what is considered at the time as the valid system pack type.

Any application that is path protected is reported.

The input parameter is:

Address The *address* is any drop or drop and continue STS-1 path or STS-3c path. The default is **all** for all paths in the system.

Valid STS-1 Addresses for OC-12 OLIUs:
all, {mb1,mb2}-{1-12,all}

Valid STS-3c Addresses:
all, {mb1,mb2}-{1,4,7,10,all}

The output report appears as follows:

```
/* Path Protection Switch State Report
   ============================================================
   ---------- Ring 1 -----------  ---------- Ring 2 -----------
   Address  Act   APS Condition   Address  Act   APS Condition
   ============================================================
   address   x     condition      address   x    condition
   address   x     condition      address   x    condition
      .      .        .              .      .        .
      .      .        .              .      .        .
      .      .        .              .      .        .
   */
```

The output parameters are:

`Address` The `address` is any STS-1 and/or STS-3c path. The report always displays both the Ring 1 and Ring 2 addresses.

`Act` This column indicates whether the associated Ring 1 path (receive into local main-b-1) or Ring 2 path (receive into local main-b-2) is active.

This column may contain one of the following:

Y The path is provisioned as drop, or drop and continue, and this side is active (path protection switching is allowed).

`(blank)` The path is provisioned as drop, or drop and continue, and this side is in standby.

`APS Condition` This column lists the condition that caused the automatic protection switch to occur and appears on the path where the condition was detected. (The manual protection switch request is not shown because the system is nonrevertive.) The condition may be one of the following:

`signal failure`

`pack removal`

`pack failure`

`signal degrade`

Only manual or automatic protection switch (APS) requests that are higher priority than the currently active requests will cause a protection switch to occur. Currently, only the `manual` protection switch request is

allowed, and because it is a lower priority than the APS requests, only APS requests will appear in the report. The APS conditions will remain active while the condition that caused the switch still exists. When that failure clears, the APS condition is changed to blank if no other APS requests exist.

RELATED COMMANDS

rtrv-state-eqpt

switch-path-sts1

switch-path-sts3c

NAME

rtrv-state-sts1: Retrieve State of STS-1 Channels

INPUT FORMAT

`rtrv-state-sts1`[:*`Address`*];

DESCRIPTION

This command retrieves STS-1 channel states.

NOTE:
If slots 1 and 2 are equipped with different pack types (for example, during and upgrade), the report will include data for what is considered at the time as the valid system pack type.

The input parameter is:

`Address` Address is the address of the STS-1 channels whose state is to be reported. The default is **`all`** STS-1 channels. Other valid addresses are: **`{mb}-{1-12,all}`**, **`{a,b,c,d}-{1-3,all}`**.

The output report appears as follows.

```
/* STS-1 Channel State Report
================================================================
Address     Channel State
================================================================
mb-1        AUTO
mb-2        IS
mb-3        NMON
 .           .
 .           .
*/
```

NOTE:
An empty report is displayed if there are no cross-connections or if no channels are monitored (for example, pass-through cross-connections).

The output parameters are:

`Address` Address is the address of an STS-1 channel.

`Channel State` Channel State is the state of the STS-1 channel identified in the address field. It may have one of the following values:

- `auto` Automatic. There is not a good signal on this channel. (STS-1 AIS or STS-1 loss of pointer [LOP] condition may be present.) Alarm or status conditions associated with this channel are not reported. Performance monitoring is not done for the channel. If a good signal is detected on this channel, then the channel will be put in the `in-service` state automatically.
- `is` In-service. The channel is monitored. Alarm and status conditions are reported normally.
- `nmon` Not Monitored. The channel is not being monitored. Alarm and status conditions are not reported for this channel. Performance monitoring is not done for the channel. The channel will remain in this state until the state is changed (with the **`set-state-sts1`** command) or until the cross-connection involving this channel is deleted.

RELATED COMMANDS

set-state-sts1

upd

NAME

rtrv-state-sts3c: Retrieve State of STS-3c Channels

INPUT FORMAT

`rtrv-state-sts3c`[:*`Address`*];

DESCRIPTION

This command retrieves STS-3c channel states.

This command is available with all OC-12 ring releases.

The input parameter is:

`Address` Address is the address of the STS-3c channels whose state is to be reported. The default is **`all`** STS-3c channels. Other valid addresses are: **`{mb}-{1,4,7,10,all}`**.

The output report appears as follows. Only channels that are cross-connected will be displayed in the output report.

```
/* STS-3c Channel State Report
================================================================
Address     Channel State
================================================================
mb-1        auto
mb-4        is
mb-7        nmon
mb-10       is
 .          .
 .          .
 .          .
*/
```

The output parameters are:

`Address` Address is the address of an STS-3c channel.

`Channel State` Channel State is the state of the STS-3c channel identified in the address field. It may have one of the following values:

- `auto` Automatic. There is no good signal on this channel. Alarm or status conditions associated with this channel are not reported. If a good signal is detected on this channel, then the channel will be put in the "In Service" state automatically.
- `is` In Service. The channel is monitored. Alarm and status conditions are reported normally.
- `nmon` Not Monitored. The channel is not being monitored. Alarm and status conditions are not reported for this channel. The channel will remain in this state until the state is changed (with the **`set-state-sts3c`** command) or until the cross-connection involving this channel is deleted (ring releases).

RELATED COMMANDS

dlt-crs-sts3c

ent-crs-sts3c

rtrv-crs-sts3c

set-state-sts3c

update

NAME

rtrv-sts1: Retrieve STS1

INPUT FORMAT

`rtrv-sts1`[:*`Address`*];

DESCRIPTION

This command retrieves two types of provisioned parameters for STS-1 channels. The parameter types are:

- signal degrade alarm threshold
- alarm level for sa/nsa STS path AIS condition

NOTE:
If slots 1 and 2 are equipped with different pack types (for example, during an upgrade), this report will include data for what is considered at the time as the valid system pack type.

The input parameter is:

`Address` Address is the address of the STS-1 channels whose parameters are to be reported. The default is **`all`** STS-1 channels. Other valid addresses are: **`{mb}-{1-12,all}`**.

Only STS-1 channels that are cross-connected will be displayed in the output report.

When the default address is entered, the output report appears as follows:

```
/* STS1 Channel Provisioning Report
=====================================================
SignalDegrade = value

STS-1 AIS Alarm Information
Address      AIS Alarm            AIS Alarm
           Service Affecting  Non Service Affecting
=====================================================
address         sa                nsa
address         sa                nsa
  .             .                 .
  .             .                 .
*/
```

If the address is anything but **all**, then the report appears as follows:

```
/* STS-1 Channel Provisioning Report
=====================================================
Address        AIS Alarm           AIS Alarm
           Service Affecting  Non Service Affecting
=====================================================
address        sa                   nsa
address        sa                   nsa
  .             .                    .
  .             .                    .
  .             .                    .
*/
```

If the **nsa** parameter is not valid for the application, for example a non-ring application, then the report appears as:

```
/* STS-1 Channel Provisioning Report
============================================
Address        AIS Alarm
           Service Affecting
============================================
address        sa
address        sa
  .             .
  .             .
  .             .
*/
```

The output parameters are:

`SignalDegrade` This is the signal degrade threshold value.

`address` This is the address of the provisioned channel.

`AIS Alarm` One or more columns of information will show the AIS alarm values for service affecting (SA) and non-service affecting (NSA) alarms. SA alarms may have one of the following values:

- **cr** Critical alarm (default for ring channels)
- **mn** Minor alarm (non-ring channels only, default)
- **na** Not alarmed, but reported
- **nr** not alarmed and not reported (non-ring channels only).

NSA alarms may have one of the following values:

- **mn** Minor alarm (default)
- **nr** Not alarmed and not reported.

RELATED COMMANDS

set-sts1

NAME

rtrv-sts3c: Retrieve STS3c

INPUT FORMAT

`rtrv-sts3c`[:*`Address`*]

DESCRIPTION

This command retrieves information about the dropped STS-3c channels. This information consists of the signal degrade threshold value and the STS-3c path AIS alarm value that was provisioned using **`set-sts3c`** command.

The input parameter is:

`Address` Address is the address of the STS-3c channels whose state is to be reported. The default is **`all`** STS-3c channels. Other valid addresses are: **`{mb}-{1,4,7,10,all}`**.

Only STS-3c channels that are cross-connected will be displayed in the output report. The output report appears as follows:

```
/* STS-3c Channel Provisioning Report
============================================
SignalDegrade = value

STS-3c AIS Alarm Information
Address       AIS Alarm           AIS Alarm
           Service Affecting  Non Service Affecting
============================================
address       sa                    nsa
address       sa                    nsa
  .           .                     .
  .           .                     .
  .           .                     .
*/
```

The output parameters are:

`SignalDegrade` This is the signal degrade value. The signal degrade has a value in the range -5 through -9 and default value of -6.

`address` This is the address of the provisioned channel.

`AIS Alarm` One or more columns of information will show the AIS alarm values for service affecting (SA) and non-service affecting (NSA) alarms. SA alarms may have one of the following values:

`cr` Critical alarm (default for ring channels)

`mn` Minor alarm (non-ring channels only, default)

`na` Not alarmed, but reported

`nr` not alarmed and not reported (non-ring channels only)

NSA alarms may have one of the following values:

`mn` Minor alarm (default)

`nr` Not alarmed and not reported

RELATED COMMANDS

set-sts3c

NAME

rtrv-sync: Retrieve Synchronization

INPUT FORMAT

`rtrv-sync`;

DESCRIPTION

This command displays the provisioning and operational information on the synchronization attributes of the DDM-2000, as set by the **`set-sync`** command.

NOTE:
Beginning with DDM-2000 OC-12 Release 7.0 and later, this command will also be used with the new Stratum 3 timing circuit pack, TG3 (BBF4). This pack can not be used in combination with either of the two TGS circuit packs (BBF2/BBF2B) in the same network element. The BBF4 circuit pack can be used in any BBF2B application. Care must be taken to ensure that a system equipped with these new BBF4 circuit packs will not receive its sync source for line-timing from another system that is equipped with either BBF2 or BBF2B TGS packs.

The following pages show output reports for this command and explain the various fields on the reports. Output reports will vary according to the provisioned timing mode and the software release.

The `(hw)` after a parameter value on the following reports indicate that the parameter is set by hardware switches on the TGS or TG3 circuit pack.

The synchronization output report on the following page is the general format for a system equipped with TGS or TG3 circuit packs that include DS1 timing outputs in the sync mode.

The following report is for OC-12 Releases:

```
/* Synchronization Report
 ================================================================
 Parameter                    Value(s)
 ================================================================
 Sync Source (src)            address  timing_message

 DS1 Line Code/Format         tg-1=xxxx/xxx (hw)  tg-2=xxxx/xxx (hw)

 Shelf Timing
   Provisioned Mode           mode (hw)
   Active Timing Mode         mode (hw)
   DS1 Reference Input State  ref-1=mode       ref-2=mode
   Active Circuit Pack        pack
   Active Reference/Line      ref
   Mode Switching (mdsw)      mode
   Last Reference Switch      YY-MM-DD HH:MM:SS

DS1 Outputs
   Provisioned Mode           mode (hw)
   DS1 Output Mode (omd)      mode
   AIS Threshold (aisthres)   thres (Message)
   DS1 Output State           refout-1=state   refout-2=state
   Active Reference           ref

 Sync Message Information
   OC-N Line      Input Message     Output Message     Type
-------------------------------------------------------------------
   address          Message            Message         Type
   address          Message            Message         Type
   address          Message            Message         Type

 Sync Autoreconfiguration    mode
*/
```

The output parameters for the reports are as follows. Some parameters may not apply to all the reports. The output parameters are:

`Sync Source` The sync source is the optical line provisioned from which shelf (and optionally, DS1 sync output) timing is derived. If the shelf timing mode is set for `LineTimed` and DS1 sync output timing is also selected, `Sync Source` is both the source for shelf timing and DS-1 sync outputs. If the shelf timing mode is set for `External` and DS1 sync output timing is also selected, `Sync Source` is only the source for DS-1 sync outputs. The valid values for this parameter are:

`main-b-1`	OC-12 Ring Releases (default)
`main-b-2`	OC-12 Ring Releases

— (dash)	Timing mode is hardware provisioned to be FreeRunning or External without DS1 sync outputs (`mult`).

The choices for Sync Source (except the dash) are followed by one of these messages:

`for Shelf only`	Sync Source is set for LineTimed shelf.
`for Shelf and DS1 Outputs`	Sync Source is set for LineTimed shelf/Sync Out.
`for DS1 Outputs only`	Sync Source is set for External shelf timing/Sync Out.

`DS1 Line Code/Format`

This refers to the signal format and line coding of the DS1 `External` timing references (as set with option switches on the TGS or TG3 circuit pack). The valid values are:

`DS1 Line Code`

`ami`	Alternate Mark Inversion
`b8zs`	Bipolar with 8 Zeros Substitution
— (dash)	Unequipped
`?`	Unreadable

`DS1 Line Format`

`sf`	Super Frame format (D4)
`esf`	Extended Super Frame format
— (dash)	Unequipped
`?`	Unreadable

`Provisioned Mode`

Provisioned Mode is the provisioned synchronization mode of the timing generator circuit packs, as set with option switches on the TGS or TG3 circuit pack. The valid values are:

`External`	Timing derived from DS1 External reference.
`FreeRunning`	Timing derived from internal oscillator.
`LineTimed`	Timing derived from the OC-12 payload-carrying signal in the Main-b slots.

`Active Timing Mode`

Active timing mode is the active timing synchronization mode of the system. The value may be any of the values listed previously in `Provisioned Mode` or one of the following:

`Holdover`	Timing generator is operating in holdover mode because the provisioned references are not available or because the system has been manually switched to holdover mode.
`No Timing`	Timing circuit packs have been removed.
`?`	Timing mode is unreadable.

`DS1 Reference Input State`

Input State refers to the primary state of the DS1 `External` timing reference ports, with values as follows:

`is`	in-service
`auto`	automatic

`Active Circuit Pack`

Active Circuit Pack indicates which timing generator circuit pack is currently active. The value is `tg-1`, `tg-2`, or `-` (empty slot).

`Active Reference/Line`

Active Reference is the active external reference for the timing generator. When Active Reference is reported, Active Line is not reported. When the Provisioned Mode is `External`, Active Reference has the following values:

`ref-1`	The active timing reference is set to the timing reference "one".
`ref-2`	The active timing reference is set to the timing reference "two".
—	Not applicable, DS1 references are in auto input state.

Active Line is the active LineTimed reference for the timing generator. When Active Line is reported, Active Reference is not reported. When Provisioned Mode is `LineTimed`, Active Line has the following values:

`main-b-1`	
`main-b-2`	
`NA`	Neither timing reference is active.

When the active timing mode is `Holdover`, Active Reference/Line is the timing reference that will provide timing if the system switches out of holdover mode.

When the Provisioned Mode is `FreeRunning` , Active Reference and Active Line are not reported.

`Mode Switching`
Mode Switching indicates whether the mode switching for the timing generator is revertive or nonrevertive.

`Revertive`	Revertive mode switching. If the system is provisioned for revertive mode switching, it will automatically switch from holdover mode to the provisioned mode (`LineTimed` or `External` timing) when a good reference becomes available.
`Nonrevertive`	Nonrevertive mode switching. If the system is provisioned for nonrevertive mode, it will switch to holdover mode (as a result of a timing reference failure) and remain in this mode until it is manually switched back to the provisioned timing mode by the **`switch-sync`** command.
— (dash)	Not applicable. Provisioned mode is `FreeRunning`.

`Last Reference Switch`
Last Reference Switch Time is the date and time of the last switch of the `External` timing reference. It has an initial power-up value of "NA" which is retained until a reference switch occurs. The value of Switch Time (the instant a switch occurs) is obtained from the system clock. This parameter is reported only when the Provisioned Mode is `External`.

`DS1 Outputs`
DS1 Outputs is the DS1 timing outputs and can be provisioned by hardware switches on the circuit pack. If the DS1 outputs are mult, then only Provisioned Mode is reported for this section.

`Provisioned Mode`

`mult` In the `External` timing mode, the `mult` is used to distribute the incoming DS1 reference to other shelves in the bay.

`sync out`
This mode indicates that timing is derived from a terminating OC-12 line and is used for network synchronization. (This mode is only available with the BBF2B or BBF4 circuit pack.)

`DS1 Output Mode`
Output Mode identifies whether the DS1 timing output derivation will track transmission or lock on a particular line (1 or 2) with values:

`track`

`lock1`

`lock2`

DS1 Output Mode is not reported for ring releases.

`AIS Threshold`
This parameter indicates the provisioned sync message quality level and its equivalent sync message phrase for the active reference at which, or greater incoming quality level numbers, DS1 AIS will be transmitted on the sync output of the BBF2B TGS or BBF4 TG3 circuit pack. If the `syncmsg` parameter within the **`set-oc3`** or **`set-oc12`** command is set to `disabled`, then the word `disabled` will be reported with the provisioned value of this parameter. It may be set to one of the following options:

`level5`	default value. (K2: Internal Clock, S1: Traceable SONET Clk, or disabled)
`level4`	(K2: Stratum 3, S1: Traceable Stratum 3, or disabled)
`level3`	(K2: Stratum 2, S1: Traceable Stratum 2, or disabled)
`level2`	(K2: Sync Quality Unknown, S1: Sync Trace Unknown, or disabled)

For a definition of quality levels, refer to the Sync Message Information section of this command pages.

`DS1 Output State`
The output state is the status of the DS1 output when in the *`sync out`* mode, and may be one of the following:

`good` This status indicates that the DS1 output is traceable to the incoming OC-12 line.

AIS — DS1 AIS is inserted if a failure exists that prohibits tracing of the DS1 output to the incoming optical line. It is also inserted due to certain incoming synchronization message quality levels on the active timing source.

— — Indicates the slot is in the auto state.

? — The circuit pack is unreadable, or slot is equipped and empty.

`Active Reference`
This shows the actual line that the DS1 timing output is being derived from, with the following values:

`main-b-1`

`main-b-2`

`Sync Message Information`
This heading identifies the section of the report where input and output messages used to determine the timing source quality are listed. This section of the report is available only if the `kbyte` message parameter is set to **`enabled`**. this section of the report is available only if any of the optical interfaces has been provisioned for `kbyte` (default) or `Sbyte` sync messaging (using the **`set-oc3`** command) or the **`set-oc3/set-oc12`** (when Main has 24-type OLIUs). (using the **`set-oc3/oc12`** commands).

`OC-N Line`
This parameter identifies the addresses of optical interfaces that can carry sync messages.

`Input Message`

`disabled` — Indicates that the field is not applicable (for example, if synchronization messaging is disabled).

? — Indicates that the message is not readable (for example, due to a line failure).

This column identifies the `Kbyte` input message received on each optical interface line, and may have one of the following values:

`Don't Use` — The interface is not suitable for synchronization timing (Quality Level 7).

`Timing Looped Back`
: The network element connected to this interface is line-timed from it (Quality Level 7).

`Stratum 4`
: The interface is receiving timing from a Stratum 4 clock source (Quality Level 6).

`Internal Clock`
: This interface is receiving timing from a system in holdover or free running (Quality Level 5). This is applicable to the DDM-2000 systems equipped with TGS (BBF2 or BBF2B) circuit packs.

`Stratum 3`
: The interface is receiving timing from a Stratum 3 clock source (Quality Level 4) or from a DDM-2000 system equipped with TG3 (BBF4) circuit packs that is either in holdover or free running.

`Stratum 2`
: The interface is receiving timing from a Stratum 2 clock source (Quality Level 3).

`Sync Quality Unknown`
: This interface is receiving timing from a good quality clock source (Quality Level 2).

`Stratum 1`
: The interface is receiving timing from a Stratum 1 clock source (Quality Level 1).

The type of sync messaging can be provisioned to `Kbyte` or `Sbyte` using the **`set-oc3`** or **`set-oc12`** command. In these releases, both versions of sync messages could appear in the report if the optical interfaces have been provisioned for the two types of messages. If `Sbyte` is selected, the following input messages will be applicable for the optical interface:

`Don't Use`
: The interface is not suitable for synchronization timing (Quality Level 7). This message is equivalent to **`Don't Use`** in Kbyte messaging. There is no message equivalent to **`Timing Looped Back`** in Sbyte messaging.

`Reserved`
: The interface is receiving the Reserved message on S1 byte (Quality Level 7). Upon receiving this message, the system treats it the same as **`Don't Use`** message.

`Undefined` The interface is receiving a message on S1 byte that is not defined by the standards (Quality Level 7). Upon receiving this message, the system treats it the same as **`Don't Use`** message.

`Traceable SONET Clk`
The interface is receiving timing from a system in holdover or free running (Quality Level 5). This message is equivalent to **`Internal Clock`** in Kbyte messaging. This is applicable to the DDM-2000 systems equipped with TGS (BBF2 or BBF2B) circuit packs.

`Traceable Stratum 3`
The interface is receiving timing from a Stratum 3 clock source (Quality Level 4) or from a DDM-2000 system equipped with TG3 (BBF4) circuit packs that is either in holdover or free running. This message is equivalent to **`Stratum 3`** in Kbyte messaging.

`Traceable Stratum 2`
The interface is receiving timing from a Stratum 2 clock source (Quality Level 3). This message is equivalent to **`Stratum 2`** in Kbyte messaging.

`Sync Trace Unknown`
This interface is receiving timing from a good quality clock source (Quality Level 2). This message is equivalent to **`Sync Quality Unknown`** in Kbyte messaging.

`PRS Traceable`
The interface is receiving timing from a Stratum 1 clock source (Quality Level 1). This message is equivalent to **`Stratum 1`** in Kbyte messaging.

`Output Message`
This identifies the output message sent out on each OC-N interface line. The valid values for this parameter are the same as those listed for `Input Message`. For systems provisioned in line timing, in addition to the above Input Messages, if the sync source is provisioned for Sbyte type of sync messaging and is receiving `Traceable Stratum 3`, `Traceable Stratum 2`, or `PRS Traceable` messages, then the output messages

on any of the optical interfaces provisioned for Kbyte will be `Stratum 3`, `Stratum 2`, or `Stratum 1`, respectively.

`Type` This column identifies the type of sync messaging the optical interface was provisioned for using the **`set-oc3`** and/or **`set-oc12`** command. The valid values are:

`Kbyte`

`Sbyte`

`disabled`

`Sync` `Autoreconfiguration`
This capability allows the system to choose the best timing source to use when it is provisioned for line timing. The valid values are **`enabled`** and **`disabled`**.

RELATED COMMANDS

rtrv-oc3

rtrv-oc12

rtrv-state

set-sync

set-oc3

set-oc12

switch-sync

NAME

rtrv-t3: Retrieve T3

INPUT FORMAT

rtrv-t3[:*Address*];

DESCRIPTION

This command displays a port provisioning report for one or all DS3 ports, as set by the **set-t3** command.

The input parameter is:

Address Address identifies the DS3 ports. One port or all ports may be specified. The default address is **all**.

Valid DS3 Port Addresses: **{a,b,c,d}-{1-3,all}, all**

The output report appears as follows:

```
/* T3 Port Provisioning Report
================================================================================
 Port    Mode   AIS   Alarm   Failure   State    PM      PM        PM
Address               Level  Threshold          Mode   Frame   Format
================================================================================
address  mode   ais   alarm     fth     state   pmmd   frame      fmt
   .       .     .      .        .        .       .      .         .
   .       .     .      .        .        .       .      .         .
   .       .     .      .        .        .       .      .         .
   .       .     .      .        .        .       .      .         .
*/
```

The output parameters are:

`Port Address` Port Address is the address of the DS3 port

`Mode` Mode is the violation monitor removal mode of the DS3 signal. It may have one of the following values:

- `vmr` Monitor and remove DS3 P-bit errors (default value).
- `vm` Monitor but do not remove DS3 P-bit errors.
- `cc` Clear channel. Do not monitor or remove DS3 P-bit errors.
- — This parameter does not apply to the BBG20 TMUX circuit pack.

`AIS` AIS indicates whether or not a DS3 alarm indication signal (AIS) should be inserted. The value may be `yes` or `no`. This parameter is not applicable to the BBG20 TMUX circuit packs, therefore, a dash (—) will be displayed. When AIS is set to `yes`:

- — DS3 AIS is inserted towards the DSX-3 upon detection of an OC-N loss of signal or STS path AIS incoming from the fiber.
- — DS3 AIS is inserted towards the fiber upon detection of DS3 LOS incoming from the DSX-3.

NOTE:
AIS is always inserted if the violation monitor removal mode is provisioned for `vmr` or `vm`.

`Alarm Level` Alarm describes the alarm level for an incoming DS3 signal failure and has the following values:

- `CR` Critical alarm
- `MJ` Major alarm
- `MN` Minor alarm
- `NA` No alarm

If the system is provisioned for and reporting no alarm but an alarm exists, the NE ACTY LED on the user panel will be illuminated, and the fault LED on the circuit pack will flash. The condition will be reported in the

`Failure Threshold` Failure threshold is the BER threshold in terms of a logarithm to the base 10. The value may be either -6 or -3, corresponding to BERs of 10^{-6} and 10^{-3}, respectively.

`State` State is the state of the port with the values:

- `is` In-service. A valid T3 signal from the DSX-3 is being monitored.
- `auto` Automatic. The system is waiting for a valid T3 signal from the DSX-3.
- `nmon` Not Monitored

`PM Mode` This column shows the performance monitoring (PM) mode of the DS3 interface, and may be one of the following values:

- `on` DS3 PM enabled on this port (default value).
- `off` DS3 PM disabled on this port (PM data is not monitored or reported).
- — Indicates no DS3 path PM because `cc` was selected for `Mode`. The DS3 PM report will display the line PM data and dash lines (-) for both directions of the DS3 path PM data when a BBG11B pack is active (in-service) in a function unit slot.

`PM Frame` This parameter indicates the type of framing for the incoming DS3 signal from both the fiber and the DSX-3. For the BBG20 TMUX circuit pack, this parameter will indicate the type of DS3 signal that is received from the DSX-3 only and is transmitted towards the DSX-3. It may have one of the following values:

- `m13` The incoming DS3 signal is in M13 framing type (default value).
- `cbit` The incoming DS3 signal is in C-bit framing type.
- — Indicates no DS3 path PM because `cc` was selected for `Mode`. The DS3 PM report will display the line PM data and dash lines (-) for both directions of the DS3 path PM data when a BBG11B pack is active (in-service) in a function unit slot.

`PM Format`

This parameter indicates the type of path PMON that will appear in the DS3 PM report. This parameter will appear only if the `vmr` or `vm` mode has already been selected. For the BBF20 TMUX circuit pack, this parameter will always appear. This parameter may have one of the following values:

`pbit` When this value is selected, the DS3 PM report will display counts of SEFS as well as DS3 P-bit CV, ES, SES, and UAS (default value).

`fmbit` When this value is selected, the DS3 PM report will display counts of SEFS as well as DS3 adjusted F&M bit CV, ES, SES, and UAS.

`cpbit` When this value is selected, the DS3 PM report will display counts of SEFS as well as DS3 CP-bit parity near-end and far-end CV, ES, SES, and UAS.

— Indicates no DS3 path PM because `cc` was selected for `Mode`. The DS3 PM report will display the line PM data and dash lines (-) for both directions of the DS3 path PM data when a BBG11B pack is active (in-service) in a function unit slot.

RELATED COMMANDS

set-state-t3

set-t3

NAME

rtrv-tl1msgmap: Retrieve Message Map for Operation Systems

INPUT FORMAT

`rtrv-tl1msgmap;`

DESCRIPTION

This command displays the table that associates the OS Application Context Identifier (ACID) to TL1 autonomous message types. This allows the DDM-2000 network element to direct messages to the proper OS destination.

The output report appears as follows:

```
/* TL1 Autonomous Message Map
=============================================================================
    ACID                 ALM ENV CON DB  EVT PM  SW
=============================================================================
tl1Maintenance          | x | x | x |   | x | x | x |
tl1MemoryAdministration |   |   |   | x |   |   |   |
tl1Test                 |   |   |   |   |   |   |   |
tl1PeerComm             |   |   |   |   |   |   |   |
tl1Other1               | x | x | x | x | x |   | x |
tl1Other2               |   |   |   |   |   |   |   |

      x - enabled
<blank> - disabled
*/
```

The output parameters are:

ACID ACID is the Application Context ID to be assigned to a particular SNPA or SubNetwork Point of Attachment on the x.25 channel. Each ACID defines the type of TL1 messages to be sent by the network element. Default MessageType mappings exist for ACIDs supported by DDM-2000. Supported ACID values are:

tl1Maintenance

tl1MemoryAdministration

tl1Other1

tl1Test

tl1PeerComm

tl1Other2.

msgtype MessageType is one of the supported classes of TL1 messages that the system generates. These message types are not sent to the OS unless they are enabled and associated to an ACID. The supported message types are:

ALM - REPT ALM

ENV - REPT ALM ENV

CON - REPT COND

DB - REPT DBCHG

EVT - REPT EVT

PM - REPT PM

SW - REPT SW

RELATED COMMANDS

ent-osacmap

dlt-osacmap

rtrv-osacmap

ent-tl1msgmap

NAME

rtrv-trace-sts1: Retrieve Path Trace Characteristics

INPUT FORMAT

`rtrv-trace-sts1`:*`Address`*;

DESCRIPTION

This command retrieves the provisioned transmit and receive path traces for the STS cross-connected STS-1 channel. The command also outputs the actual receive path trace, and the status of the path trace.

NOTE:
For OC-12, this feature is only applicable to the STS path terminated to a BBG11B circuit pack.

The input parameter is:

`Address` This is a STS-1 channel address of the SONET path terminating signal for which the path trace is assigned.

Valid Addresses (within OC-12): **`mb-{1-12,all}`**
For Valid Addresses (within OC-3): **`{a,b,c,d}-{1-3,all}`**

The output report appears as follows:

```
/* STS-1 Path Trace Report
================================================================================
Address
Parameter Value
================================================================================
m-1
Status: MISMATCH
INCTRC: ActualReceiveTraceWhichDoesNotMatchProvisionedReceiveTrace789123
EXPTRC: ProvisionedTransmitTraceyzabcdefghijklmnopqrstuvwxyz1234567891
TRC   : ProvisionedReceiveTracexyzabcdefghijklmnopqrstuvwxyz1234567891
--------------------------------------------------------------------------------
m-2
Status: GOOD
INCTRC: AID2Receivelmnopqrstuvwxyzabcdefghijklmnopqrstuvwxyz
EXPTRC: AID2Transmitmnopqrstuvwxyzabcdefghijklmnopqrstuvwxyz
TRC   : AID2Receivelmnopqrstuvwxyzabcdefghijklmnopqrstuvwxyz
--------------------------------------------------------------------------------
m-3
Status: MISMATCH
INCTRC:
EXPTRC: AID2Transmitmnopqrstuvwxyzabcdefghijklmnopqrstuvwxyz
TRC   : AID2Receivelmnopqrstuvwxyzabcdefghijklmnopqrstuvwxyz1234567891
--------------------------------------------------------------------------------
mb-1
Status: MISMATCH
INCTRC: ActualReceiveTraceWhichDoesNotMatchProvisionedReceiveTrace789123
EXPTRC: ProvisionedTransmitTraceyzabcdefghijklmnopqrstuvwxyz1234567891
TRC   : ProvisionedReceiveTracexyzabcdefghijklmnopqrstuvwxyz1234567891
--------------------------------------------------------------------------------
mb-2
Status: GOOD
INCTRC: AID2Receivelmnopqrstuvwxyzabcdefghijklmnopqrstuvwxyz
EXPTRC: AID2Transmitmnopqrstuvwxyzabcdefghijklmnopqrstuvwxyz
TRC   : AID2Receivelmnopqrstuvwxyzabcdefghijklmnopqrstuvwxyz
--------------------------------------------------------------------------------
mb-3
Status: MISMATCH
INCTRC:
EXPTRC: AID2Transmitmnopqrstuvwxyzabcdefghijklmnopqrstuvwxyz
TRC   : AID2Receivelmnopqrstuvwxyzabcdefghijklmnopqrstuvwxyz1234567891
--------------------------------------------------------------------------------
 .    .   .   .   .
 .    .   .   .   .
mb-12
Status: MISMATCH
INCTRC:
EXPTRC: AID2Transmitmnopqrstuvwxyzabcdefghijklmnopqrstuvwxyz
TRC   : AID2Receivelmnopqrstuvwxyzabcdefghijklmnopqrstuvwxyz1234567891
*/
```

The output parameters are:

Address This is a channel address of the SONET path terminating signal for which the path trace is assigned.

Status STS path trace status. This is a status report of the incoming trace. For **rtrv-trace-sts1** messages, *status* may have one of the following values:

GOOD	Good. This indicates that the *INCTRC* and the *EXPTRC* match.
MISMATCH	Mismatch. This indicates that the *INCTRC* and the *EXPTRC* do not match.
UNAVAILABLE	Unavailable. This indicates that there is no *INCTRC* because there has been a path interruption. This is also true for the STS path terminating to other than a BBG4B or BBG11B circut pack, for which the path trace is unavailable.

INCTRC Incoming Path trace message. This indicates the incoming Path Trace (J1) content.

EXPTRC Expected incoming Path trace message. This indicates the expected Path Trace (J1) content.

TRC Outgoing Path trace message. This identifies the path trace message to be transmitted.

If the STS-1 channel for which the **rtrv-trace-sts1** command was issued is not available, the request will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* Address points to a non-existent channel. */
```

RELATED COMMANDS

set-pthtrc-sts1

NAME

rtrv-ulsdcc-l3: Retrieve Upper Layer Section DCC - Layer 3

INPUT FORMAT

`rtrv-ulsdcc-l3`;

DESCRIPTION

NOTE:
This command page describes the functionality of the **`rtrv-ulsdcc-l3`** command in OC-12 Release 7.0 and all later TARP releases.

This command is currently used to retrieve the parameters in Layers 3 through 7 of the OSI stack, many of which are provisioned by the **`ent-ulsdcc-l3`** command. Layer 3 parameters include the fields of the network service access point (NSAP) address and the enable/disable state of Level-2 IS-IS Routing.

The NSAP is a 20-byte address that provides unique identification for each network element. Only certain portions of this address are user-settable.

The output report appears as follows:

```
/* Upper Layer Section DCC Provisioning Report
=================================================================
L3 NSAP address:
 idp    dfi org    res  rd   area  sys          sel   lv2is
 xxxxxx xx  xxxxxx xxxx xxxx xxxx  xxxxxxxxxxxx xx    e/d

*/
```

The output parameters are:

`L3 NSAP Address`
This is the 20-byte address assigned to a network element. This is only a string. Under this string, the following seven parameters that make up the NSAP address are identified:

`idp` Where "xxxxxx" indicates the 6-digit hexadecimal IDP field value of the local NE NSAP. This part of the NSAP address is

assigned according to the International Standards Organization (ISO) standards. For SONET systems, the value is set to `39840F` to indicate that U.S. American National Standards Institute (ANSI) is the registration authority responsible for the assignment of the NSAP address.

`dfi` Where "xx" indicates the 2-digit hexadecimal DFI field value of the local NE's NSAP. This part of the NSAP address specifies the format for the rest of the NSAP address. For SONET systems, the value is set to hex `0X80`. This is to specify that a format in alignment with GOSIP version 2 is to be used.

`org` Where "xxxxxx" indicates the 6-digit hexadecimal Organization Id field value of the local NE's NSAP. This part of the NSAP address contains the allocated hexadecimal company code assigned by the ANSI-administered USA Registration Authority for OSI Organization Ids.

`res` Where "xxxx" indicates the 4-digit hexadecimal Reserved field value of the local NE's NSAP. This part of the NSAP address currently has not been assigned a specific purpose by the SONET standards.

`rd` Where "xxxx" indicates the 4-digit hexadecimal Routing Domain field value of the local NE's NSAP. This field is user provisionable. However, until the standard use of this field is defined, this parameter should not be provisioned to a value other than its default value.

`area` Where "xxxx" indicates the 4-digit hexadecimal Routing Area field value of the local NE's NSAP. It is used to identify NEs in the same area. Where multiple areas are defined, IS-IS Level-2 Routing needs to be enabled to allow addressing across areas. This field is user provisionable.

`sys` Where "xxxxxxxxxxxx" indicates the 12-digit hexadecimal System Id field value of the local NE's NSAP. This part of the NSAP address is assigned by IEEE administrators to U.S.-manufactured systems to guarantee a globally-unique NSAP.

sel Where "xx" indicates the 2-digit hexadecimal Selector Id field value of the local NE's NSAP. This part of the NSAP address is used to differentiate multiple NSAP addresses within a system. The value of this field is not fixed, but is set in a PDU according to its usage; it is set to "AF" in hex when TARP is run over CLNP. IT has a value of "1D" in hex when TP4 is run over CLNP. IT may be set to "00" in hex for other uses. When retrieved and displayed, it will always be shown as "00" in hex.

lv2is This parameter indicates if the local NE is enabled as an IS-IS Level 2 Router. Possible values are either e for enable or d for disable.

RELATED COMMANDS

ent-ulsdcc-l3

ent-ulsdcc-l4

dlt-ulsdcc-l4

NAME

rtrv-ulsdcc-l4: Retrieve Upper Layer Section DCC - Layer 4

INPUT FORMAT

rtrv-ulsdcc-l4[:**tdc_rpt=***tdc_rpt*];

DESCRIPTION

NOTE:
This command page describes the functionality of the **rtrv-ulsdcc-l4** command in OC-12 Release 7.0 and all later TARP releases.

This command is used to retrieve the parameters in Layer 4 of the OSI stack, many of which are provisioned by the **ent-ulsdcc-l4** command. Layer 4 parameters include the TARP timers and TARP Data Cache provisioned parameters and the TARP Manual Adjacencies. the TARP TARP Data Cache information may be retrieved if its retrieval is enabled through the *tdc_rpt* parameter. The input parameter is:

`tdc_rpt` TARP Data Cache reporting; This parameter enables the retrieval of TARP Data Cache. Specifying this parameter will result in the TID, the NSAP address and the protocol address type to be retrieved and output for every entry in the TARP Data Cache for local NE.

This is an optional parameter and it can have the value of either *yes* or *no*. If a value of NULL (no value) is enetered, a value of *no* is assumed and the TARP Data Cache is not retrieved. The default value of this parameter is *no*.

After entering this command, the output report appears as follows:

```
/* Upper Layer Section DCC Provisioning Report
================================================================
================================================================
L4TM data:
 L4tlif  L4t1tm L4t2tm  L4t3tm  L4t4tm L4lftm
 xxxx    xxxx   xxxx    xxxx    xxxx   xxxx
----------------------------------------------------------------
L4AJ NSAP data:
 idp    dfi org    res  rd  area  sys          sel
 xxxxxx xx  xxxxxx xxxx xxxx xxxx  xxxxxxxxxxxx xx
 xxxxxx xx  xxxxxx xxxx xxxx xxxx  xxxxxxxxxxxx xx

L4TDC data: L4etdc=enable
 L4tdctid=LT-DDM-2000
 xxxxxx xx  xxxxxx xxxx xxxx xxxx  xxxxxxxxxxxx xx
 L4tdctid=LT-DDM-2001
 xxxxxx xx  xxxxxx xxxx xxxx xxxx  xxxxxxxxxxxx xx
 L4tdctid=LT-DDM-2002
 xxxxxx xx  xxxxxx xxxx xxxx xxxx  xxxxxxxxxxxx xx
 L4tdctid=LT-DDM-2003
 xxxxxx xx  xxxxxx xxxx xxxx xxxx  xxxxxxxxxxxx xx
  .
  .
  .
  .
  .
  .
  .
  .
*/
```

The output parameters are:

`L4TM data` This is only a string and under this string, the following parameters are identified:

`L4tlif` This parameter reports on the TARP lifetime parameter in TARP PDUs originated by the local NE. The TARP lifetime specifies the maximum number of hops allowed for a TARP PDU. When this number of hops is exceeded, the TARP PDU will not be forwarded. This parameter may have a value in the range from 1 to 65535. The default value for this parameter is 100.

`L4t1tm` This parameter indicates the TARP Timer T1. T1 is the maximum time waiting for response to TARP Type 1 request PDU (search level 1 routing area). This parameter may have a value in the range from 1 to 3600 seconds. Its default value is 15 seconds.

`L4t2tm` This parameter indicates the TARP Timer T2. T2 is the maximum time waiting for response to TARP Type 2 request PDU (search outside of level 1 area). This parameter may have a value in the range from 1 to 3600 seconds. Its default value is 25 seconds.

`L4t3tm` This parameter indicates the TARP Timer T3. T3 is the maximum time waiting for response to Address resolution request (type 5, example: requesting the TID when the NSAP address is known). This parameter may have a value in the range from 1 to 3600 seconds. Its default value is 40 seconds.

`L4t4tm` This parameter indicates the TARP Timer T4. T4 starts when T2 expires. It is used for error recovery. This parameter may have a value in the range from 1 to 3600 seconds. Its default value is 20 seconds.

`L4lftm` This parameter indicates the TARP Loop Detection Buffer Flush Timer. It sets the time period for flushing the TARP Loop Detection Buffer. This parameter may have a value in the range from 1 to 1440 minutes. Its default value is 5 minutes.

`L4AJ NSAP` This header indicates that what follows is the 20-byte (40-digit hex) NSAP address of an entry in the TARP Manually Adjacent NE list. A maximum of two Manually Adjacent NEs can be assigned to an NE.

ajidp Where "xxxxxx" indicates the 6-digit hexadecimal IDP field value of the Manually Adjacent NE.

ajdfi Where "xx" indicates the 2-digit hexadecimal DFI field value of the Manually Adjacent NE.

ajorg Where "xxxxxx" indicates the 6-digit hexadecimal Organization field value of the Manually Adjacent NE.

ajres Where "xxxx" indicates the 4-digit hexadecimal Reserved field value of the Manually Adjacent NE.

ajrd Where "xxxx" indicates the 4-digit hexadecimal Routing Domain field value of the Manually Adjacent NE.

ajarea Where "xxxx" indicates the 4-digit hexadecimal Area field value of the Manually Adjacent NE.

ajsys Where "xxxxxxxxxxxx" indicates the 12-digit hexadecimal System ID field value of the Manually Adjacent NE.

ajsel Where "xx" indicates the 2-digit hexadecimal Selector field value of the Manually Adjacent NE, which is currently reported as "00".

`L4TDC data` This is only a string and under this string, the following parameters are identified:

L4etdc This parameter is used to Enable or Disable the TARP Data Cache. Possible values are either **enable** or **disable**. The default value is **enable**.

L4tdctid
This parameter indicates the Target Identifier (TID) portion of entry in the TARP Data Cache (TDC). This parameter has a maximum of 20 characters and it has no default value.

tdcidp Where "xxxxxx" indicates the 6-digit hexadecimal IDP field value of the NE that was manually entered into the TDC.

tdcdfi Where "xx" indicates the 2-digit hexadecimal DFI field value of the NE that was manually entered into the TDC.

tdcorg Where "xxxxxx" indicates the 6-digit hexadecimal NSAP's Organization Id field value of the NE that was manually entered into the TARP Data Cache. It specifies the allocated Network Services Provider Code assigned by the ANSI-administered USA Registration Authority for OSI Organization Names. The default value for this parameter is "000000" hex.

tdcres Where "xxxx" indicates the 4-digit hexadecimal NSAP's Reserved field value of the NE that was manually entered into the TARP Data Cache. This is a two byte (4-digit hex) NSAP Reserved field of the NE that is to be manually entered into the TDC. The default value for this parameter is the NSAP's Reserved field of local NE.

tdcrd Where "xxxx" indicates the 4-digit hexadecimal NSAP's Routing Domain field value of the NE that was manually entered into the TARP Data Cache. This is a 2 byte (4-digit hex) NSAP Routing Domain field of the NE to be manually entered into the TDC. The default value for this parameter is the NSAP's Routing Domain field of local NE.

tdcarea Where "xxxx" indicates the 4-digit hexadecimal NSAP's Routing Area field value of the NE that was manually entered into the TARP Data Cache. It identifies the Area within the Routing Domain to which the NSAP address belongs. This is a 2 byte (4-digit hex) NSAP Area field of the NE to be manually entered into the TDC. The default value for this parameter is the NSAP's Area field of local NE.

tdcsys Where "xxxxxxxxxxxx" indicates the 12-digit hexadecimal NSAP's System Id field value of the NE that was manually entered into the TARP Data Cache.

The default value for this parameter is the value of the System Identifier Area field of the local NE.

`tdcsel` Where "xx" indicates the 2-digit hexadecimal NSAP's Selector Id field value of the NE that was manually entered into the TARP Data Cache. This parameter is currently being reported as "00".

RELATED COMMANDS

ent-ulsdcc-l4

ent-ulsdcc-l3

dlt-ulsdcc-l3

dlt-ulsdcc-l4

NAME

rtrv-x25: Retrieve X.25 link

INPUT FORMAT

`rtrv-x25;`

DESCRIPTION

Three output reports are displayed when this command is entered. The first report displays the X.25 link packet size information provisioned by the **`set-x25`** command, and the second report shows the status of the X.25 communication. The third report provides an X.25 event history.

The X.25 link packet size output report appears as follows:

```
/* X.25 Link Provisioning Report
============================================================
TID=system_name
GNE=x

------------------------------------------------------------
PKT=pkt
*/
```

The output parameters are:

`TID` This is the system name, indicated by a string of up to 20 alphanumeric characters. The default value for `TID` is that set by the site and NE values and is a string of the form `"SitemNEn"`. The `TID` must be unique for each element in a subnetwork.

`GNE` This parameter indicates whether this system is a gateway network element (GNE), providing a TL1 interface. It has a value of `active` or `not active`.

`PKT` `Pkt` is a string with possible values of 128 or 256 (default value). The X.25 packet size is active only if this system is a GNE, otherwise it is inactive.

The second report shows the state of various X.25 communication entities. The output report appears as follows:

```
/* X.25 Communication Report
=============================================================================
Entity                  State    DTE Calling Address    Code (hex)
=============================================================================
X.25 lcn  1 (pvc)       up                              06
X.25 lcn  2 (pvc)       up                              06
X.25 lcn  3 (pvc)       up                              06
X.25 lcn 16 (svc)       up       5086901234             06
X.25 lcn 17 (svc)       down                            00
X.25 lcn 18 (svc)       down                            00
X.25 lcn 19 (svc)       down                            00
X.25 lcn 20 (svc)       down                            00
X.25 lcn 21 (svc)       down                            00
X.25 interface          down                            01
lapb                    down                            00
physical line           down                            00
*/
```

The output parameters for this report are:

`Entity` This column shows the various X.25 communication entities. The entities are:

`X.25 lcn 1 (pvc)`
This communication channel is considered to be **up** upon the successful acknowledgement of the RESET_REQ_IND packet with a RESET_CONFRM packet. This does *not* imply that TL1 communication is active.

`X.25 lcn 2 (pvc)`
This communication channel is considered to be **up** upon the successful acknowledgement of the RESET_REQ_IND packet with a RESET_CONFRM packet. This does *not* imply that TL1 communication is active.

`X.25 lcn 3 (pvc)`
This communication channel is considered to be **up** upon the successful acknowledgement of the RESET_REQ_IND packet with a RESET_CONFRM packet. This does *not* imply that TL1 communication is active.

`X.25 lcn 16 (svc)`
: This communication channel is considered to be **up** upon the successful acknowledgement of the CALL_REQ_IND packet with a CALL_ACC_CONN packet. This does *not* imply that TL1 communication is active.

`X.25 interface`
: This communication channel is considered to be **up** upon the successful acknowledgement of the RESTART_PACKET packet and the RESTART_CONFRM packet. This means that layer 3 is active and ready to establish the pvc or svc communication channel.

`lapb`
: When this communication channel is **up**, layer 2 is active and ready to send or receive a RESTART_PACKET.

`physical line`
: This X.25 physical line is up only if the `lapb` is up. A **down** physical line does not necessarily mean that the physical connection (for example, a cable) is broken but that the interfacing equipment does not acknowledge the communication with the DDM-2000.

`State`
: This parameter is explained in each one of the above entities.

`DTE Calling Address`
: SVCs are defined by their X.25 DTE Calling Address. The allowed values for this parameter are defined as 1 to 15 Binary Coded Decimal (BCD) digits. Furthermore, this parameter would only be displayed when the SVC `State` is **up** and would not be shown when the SVC `State` is **down** or if the X.25 Communication `Entity` is a PVC, X.25 interface, `lapb`, or a physical line. (no default value)

`Code (hex)`
: This column shows a hexadecimal output of the protocol states in the DDM-2000 software. This is used by technicians for diagnostic purposes.

A third output report lists an X.25 event history. The output report appears as follows:

```
/* X.25 Event History
================================================================
Date    Time       Entity   Event                Data (hex)
================================================================
01-01  00:18:48    lcn 16   xmt   CLR_CONFRM       10 10 17
01-01  00:18:47    lcn 16   rcv   CLR_REQ_IND      10 10 13 00 00
01-01  00:18:03    lcn 16   xmt   CALL_ACC_CONN    10 10 0f
01-01  00:00:21    lcn  2   rcv   RESET_CONFRM     10 03 1f
01-01  00:00:21    lcn  3   rcv   RESET_CONFRM     10 03 1f
01-01  00:00:21    lcn  1   xmt   RESET_REQ_IND    10 01 1b 00 00
01-01  00:00:21    lcn  2   xmt   RESET_REQ_IND    10 02 1b 00 00
*/
```

The output parameters for this report are:

`Date` This column shows the date the X.25 event occurred.

`Time` This column shows the time the X.25 event occurred.

`Entity` This column shows the X.25 communication entity where the event occurred.

`Event` This column lists the event and whether it was transmitted (**`xmt`**) or received (**`rcv`**) by the DDM-2000.

`Data` This column shows a hexadecimal representation of frame or packet information related to the event. This is used by RTAC personnel for diagnostic purposes.

RELATED COMMANDS

set-x25

NAME

set-attr-alm: Set Alarm Attribute

INPUT FORMAT

set-attr-alm[:**almdel=***AlarmDelay*][**,clrdel=***ClearDelay*][**,pmn=***PMN*];

DESCRIPTION

This command sets the alarm holdoff and clear delays.

The input parameters are:

almdel AlarmDelay is the delay for incoming signal and equipment failures. It sets an interval of time that a fault condition is present before an alarm is declared. The delay is in seconds, between 0 and 30, with a default value of 2.

NOTE:
If a signal degrade threshold is exceeded, the recovery interval for the signal degrade condition may be longer than the provisioned holdoff delay, and an alarm will result. For example, suppose an OC-3 interface with an alarm delay of 20 seconds and a signal degrade threshold of 10^{-6} has a signal degrade failure of 10 seconds. Since the recovery interval for a 10^{-6} error rate threshold is 15 seconds, the total length of the alarm condition (10 seconds of failure plus 15 seconds of recovery) will exceed the provisioned alarm delay of 20 seconds, and an alarm will be declared.

clrdel ClearDelay is the delay in time before an alarm can be declared to be clear. For equipment failures and signal failures (including AIS and FERF), the clear delay time interval begins when the alarm failure clears. For equipment failures, the delay is between 0 and 30 seconds, with a default value of 15 seconds. For signal failures, clear delay is fixed at 15 seconds.

pmn PMN is the Power Minor alarm level, which can be either minor (**MN**) or major (**MJ**). The default is Minor.

When input, this command will cause the following confirmation message to be displayed:

```
/* Caution! Alarm or maint. thresholds are affected by this command.
    You have selected the set-attr-alm command with these parameters:

    AlarmDelay = nn
    ClearDelay = nn */
    PMN = nn */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

rtrv-attr-alm

NAME

set-attr-cont: Set Attribute Control

INPUT FORMAT

set-attr-cont:*Address*:**desc=***Description*;

DESCRIPTION

This command is used to provision (define) the name of the environmental control points.

The input parameters are:

Address Address identifies the control point to be provisioned. There is no default for this parameter.

Valid Addresses: **cont-{1-4}**

desc Description is a descriptive name for the control point. The description may be an alphanumeric string, upper- and lower-case with no spaces, up to 26 characters long. Symbolic characters may be included in the descriptive name of the control point.

The following symbolic characters have special meanings either for the CIT interface or for the X.25 TL1 interface and cannot be included in the description:

;	semicolon	?	question mark
@	at sign		space
\	back slash	!	exclamation point
:	colon	=	equal sign
"	double quote	,	comma

All control characters and special keys cannot be included in the description.

NOTE:
This command will be denied if entered in a system whose CO/RT parameter is set to CO (via the **set-ne** command). The following denial message will be displayed:

```
ENSI
/* Equipage, Not equipped for Setting specified Information */
/* Environmental controls can be provisioned only in RT systems. */
```

RELATED COMMANDS

rtrv-attr-cont

NAME

set-attr-env: Set Attribute Environment

INPUT FORMAT

set-attr-env:*Address*[:**alm=***Alarm*][,**almtype=***AlarmType*][,**desc=***Description*];

DESCRIPTION

This command is used to provision (set) the alarm level of the environmental input points. Active inputs appear as entries in the alarm and history reports of the local network element (NE) and generate autonomous TL1 messages through the gateway network element (GNE).

The input parameters are:

Address Address identifies the environmental point to be provisioned. There is no default value for this parameter.

Valid Addresses: **env-{1-21}**, **env-{all}**

NOTE:
The address **env-{all}** is allowed only when **alm** is the only parameter used for this command. The address **env-{all}** is not allowed when the **almtype** and/or **desc** parameters are used.

alm Alarm is the provisioned alarm level of the environmental input and has the following values:

- **cr** Critical alarm
- **mj** Major alarm
- **mn** Minor alarm (default)
- **na** Not alarmed, but reported.

almtype AlarmType. This parameter is used to classify the type of alarm. The description may be an alphanumeric string, upper- and lower-case with no spaces, up to 10 characters long. The original value of AlarmType is "Misc."

desc Description is a descriptive name for the point. The description may be an alphanumeric string, upper- and lowercase with no spaces, up to 26 characters long.

The following symbolic characters have special meanings either for the CIT interface or for the X.25/TL1 interface and cannot be included in the description:

;	semicolon	*?*	question mark
@	at sign		space
\	back slash	*!*	exclamation point
:	colon	*=*	equal sign
"	double quote	*,*	comma

All control characters and special keys cannot be included in the description.

NOTE:
This command will be denied if entered in a system that has the lO/RT parameter is set to CO (via the **set-ne** command). The following denial message will be displayed:

```
ENSI

/* Equipage, Not equipped for Setting specified Information */
/* Environmental alarms can be provisioned only in RT systems. */
```

RELATED COMMANDS

rtrv-attr-cont

rtrv-attr-env

rtrv-ne

set-attr-cont

NAME

set-date: Set Date and Time

INPUT FORMAT

set-date:[**date=***Date*][,**time=***Time*];

DESCRIPTION

This command sets the date and time. Executing this command will corrupt the current quarter hour and day performance-monitoring (PM) bins.

CAUTION:
If an **apply** command is scheduled for execution (*action*=**install)**, the **set-date** command should NOT be issued before program installation is invoked and completed. The user is advised to wait until program installation is completed and the system is reset.

NOTE 1:
If security is enabled on any CIT or DCC port on a shelf, then this command is available to privileged users only for all CIT or DCC ports on the shelf.

NOTE 2:
In the event of a shelf reset, an automatic date and time recovery process takes place by reading the date and time from the remote shelf connected to the main-b interface of the local shelf (in linear applications). In ring applications, the date and time data is recovered from the remote shelf connected to Main-b-1 of the local shelf. In both linear and ring applications, if the automatic recovery fails, both date and time are set to default (**70-01-01** for date and **00:00:00** for time).

The input parameters are:

date Date is entered as six digits YYMMDD, where YY is the last two digits of the year, MM is the month, and DD is the day. Default is the current system day.

time Time is entered as six digits HHMMSS, where HH is hours (00-23), MM is minutes (00-59), and SS is seconds (00-59). Default is the current system time.

When input, this command will cause the following confirmation message to be displayed:

```
/*Caution! Execution of this command will corrupt the
    current quarterhour and current day performance monitoring data.
    You have selected the set-date command with these parameters:

    Date = YYMMDD
    Time = HHMMSS */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

apply

NAME

set-ec1: Set EC-1

INPUT FORMAT

set-ec1:*Address*:[**alm=***AlarmLevel*][**,dgr=***SignalDegradeThreshold*];

DESCRIPTION

This sets the characteristics of the EC-1 ports.

The input parameters are:

address Address is the address of one or more EC-1 ports. For OC-12, the alarm and signal degrade thresholds are set for all three ports.

Valid Addresses: **all, a-all, b-all, c-all, d-all**

alm AlarmLevel describes the alarm level for an incoming EC-1 signal failure, and has the following values:

cr Critical alarm (default value)

mj Major alarm

mn Minor alarm

na Not alarmed

dgr SignalDegradeThreshold specifies the bit error rate (BER) threshold for the EC-1 port in terms of a logarithm to the base 10 as an integer with values from -9 to -5, with a default of -6. When this threshold is crossed, an alarm will be raised and automatic protection switching of the service line will be initiated. OC-12 systems also support a value of -3, which sets a signal failure threshold for this parameter.

Entering this command will cause the following confirmation message to be displayed:

```
/* Caution!  Execution of this command may affect service.
   You have selected the set-ec1 command with these parameters:
   Address = address
   AlarmLevel = alarmlevel
   SignalDegrade= signaldegradethreshold */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

rtrv-ec1

NAME

set-feat: Set Feature

INPUT FORMAT

set-feat:**feat=***Feature*,**act=***Action*;

DESCRIPTION

This command enables a user to configure the network element for feature options that are licensed for use.

NOTE:
This command is available to privileged users only.

The input parameters are:

feat Feature is the feature option available to the user, and it may have one of the following values:

- `sts3c` This feature allows STS-3c service (concatenated signals) to be supported.

act Action is the action the user wants to perform on the listed feature, and it may have one of the following values:

- `enabled` This enables a feature option. This action will also unblock the use of commands needed by this feature.
- `disabled` This disables a feature option. This action will also block the use of commands needed by this feature. The user may be required to reprovision the shelf before disabling a feature.

If a user fails to remove all equipment or reprovision parameters associated with a feature before disabling that feature, the command will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* System must be reprovisioned to disable <Feature>. */
```

If this command is entered and no TGS (timing) packs are equipped, there is no place to store a backup copy of the feature options. Thus, the command will be denied with the following message:

```
EQWT
/* EQuipage, Wrong Type */
/* No change in provisioning - both timing slots are unequipped */
```

Enabling a feature will cause the following confirmation message to be displayed:

```
/* ACCESS TO, AND USE OF THIS <feature> FEATURE IS PERMITTED ONLY
   IF SPECIFICALLY AND EXPRESSLY AUTHORIZED UNDER THE RELEVANT
   DDM-2000 SOFTWARE AGREEMENT BETWEEN AT&T AND CUSTOMER.

   You have selected the set-feat command with the parameters:
   Feature = feature
   Action = action  */

Execute? (y/n or CANcel/DELete to quit) =
```

Disabling a feature will cause the following confirmation message to be displayed:

```
/* Caution! Execution of this command will disable all of the
   system capabilities associated with the <feature> feature
   and circuit packs which support that feature will no longer
   provide access to that feature.

   You have selected the set-feat command with these parameters:
   Feature = feature
   Action = action  */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

rtrv-feat

NAME

set-fecom: Set Far-End Communications

INPUT FORMAT

set-fecom:*Address*[:**com=***Communications*][,**nsus=***NS/US*]
[,**lanreset=***lanreset*];

DESCRIPTION

This command enables or disables communication over the section data communication channels (DCC) or IAO LAN. A DCC is an embedded overhead communications channel in the SONET line used for end-to-end communications and maintenance. The DCC carries alarm, control, and status information between network elements (NEs).

NOTE:
This command is available to privileged users only.

Starting with Release 7.0, this command will complete successfully if it is executed during a remote login session.

The input parameters are:

Address Address identifies the address of the DCC or IAO LAN.

Valid Ring DCC Addresses (0x1 or video): **dcc-all, dcc-{mb1,mb2,a1,a2,b1,b2,c1,c2,d1,d2}**

Valid Ring DCC Addresses (1+1): **dcc-all, dcc-{mb1,mb2,a,b,c,d}**

Valid OC-1 DCC Addresses: **dcc-all, dcc-{m,a,b,c}{1,2}-{1,2,all}**

Valid IAO LAN Address: **lan**
(Release 7.0 and later)

com This parameter indicates whether communication over a specified DCC or IAO LAN interface (for OC-12 Release 7.0 and later TARP releases) is enabled or disabled. The valid values are **enabled** or **disabled**. The default value is **enabled**.

Communication must be enabled/disabled per DCC-all, specific DCC, or IAO LAN. or specific DCC. As an example, at some point, communication over some DCC channels and the IAO LAN might have to be enabled at the same time. In order to enable communication over both a DCC channel and IAO LAN interface, this command will have to be executed twice; once to enable communication

over a DCC, and the other time to enable communication over the IAO LAN interface.

nsus NetworkSide/UserSide (NS/US) is the identification of the DCC identity for the NE. Each DCC on the NE must define its NS/US identity in the OSI network. When the NS/US parameter is the same at both ends, an alarm is active. *nsus* is not prompted for, if the parameter *Address* is set to **lan**, NetworkSide/UserSide may have the following parameter values:

ns Network Side (NS) defines this end of the DCC to be a network site. For DDM-2000 networks either termination of the DCC can be this value as long as the other termination is different. Default values are listed on the following page.

us User Side (US) defines this end of the DCC to be a user site. For DDM-2000 networks, either termination of the DCC can be this value as long as the other termination is different. Default values are listed on the following page.

The following chart shows default settings for the NS/US parameter:

1+1 Application	**dcc-a**		**dcc-b**		**dcc-c**		**dcc-d**	
21-type OLIUs	ns		ns		ns		ns	
0x1 or Video Applications	**dcc-a1**	**dcc-a2**	**dcc-b1**	**dcc-b2**	**dcc-c1**	**dcc-c2**	**dcc-d1**	**dcc-d2**
21-type OLIUs	ns	us	ns	us	ns	us	ns	us
Rings Applications	**dcc-m1**		**dcc-m2**					
23-type OLIUs	us		ns					

lanreset This paramater is available with OC-12 Release 7.0 and later TARP releases. This parameter is prompted for, only if *Address* is set to **lan**; it can only have the value of either "y" or "n", with a default value of "n".

If this parameter is set to "y", this will cause the resetting of the Network Element's LAN interface.

CAUTION:
Resetting an IAO LAN interface will disrupt the transactions that are in progress (for example, transmitting or receiving over LAN).

When this command is input, the following confirmation message will be displayed:

```
 /* Caution!  Network element access is affected by this command.
    You have selected the set-fecom command with these parameters:

    Address = address
    Communications = enabled
    NS/US = value */

Execute? (y/n or CANcel/DELete to quit) =
```

If the **nsus** parameter is changed, no NE reset will be caused and the following confirmation message will be displayed:

```
/* Caution!  Network Element access is affected by this command.
   You have selected the set-fecom command with these parameters:

   Address = address
   Communications = enabled
   NS/US = value */
```

If *Address* is set to **lan**, the following confirmation message will be displayed:

```
 /* Caution!  Network element access is affected by this command.
    Resetting an IAO LAN interface will disrupt the transactions
    that are in progress (i.e: transmitting or receiving over LAN).

    You have selected the set-fecom command with these parameters:

    Address = lan
    Communications = value
    LanReset = value */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

rtrv-fecom

rtrv-map-neighbor

rtrv-map-network

NAME

set-lgn: Set Login

INPUT FORMAT

`set-lgn`[:**`act=`***`Action`*];

DESCRIPTION

This command enters, edits, and deletes logins and passwords. Prior to the first use of this command, the 3 default logins are `LUC01`, `LUC02`, and `LUC03`. The default password is `DDM-2000`.

NOTE 1:
Some situations (for example, a software upgrade or a new circuit pack installation) may cause the default login to change. Users who may no longer gain system access with the `ATT`*XX* login should try `LUC`*XX*.

NOTE 2:
This command is available to privileged users only.

NOTE 3:
To enable security, a privileged user must execute the **`set-secu`** command. Creating logins and passwords does *not* automatically enable security.

A maximum of 100 (general, maintenance and reports-only user) logins is supported. When security is enabled, the following four types of users are permitted to access the system with a valid login and password:

`privileged user`	The privileged user may execute any commands, including restricted commands.
`general user`	The general user may execute any commands that are not restricted to privileged users.
`maintenance`	The maintenance user may only execute commands that access the system, extract reports, and execute maintenance functions through a specific set of commands. No privileged commands are allowed to be executed by maintenance users.
`reports-only`	The reports-only user may only execute commands that access the system and extract reports.

All users may use the **`set-passwd`** command to modify their own passwords.

The input parameters are:

act Action has one of the following values:

enter Enter a new login and password pair (default value). Login is a case-sensitive alphanumeric string consisting of a minimum of five and a maximum of ten alphabetic characters and/or numbers. When entering a new login, the type of user (`privileged user`, `general user`, `maintenance` or `reports-only`) must be specified and a password should also be assigned to the new user. A user may then use the **set-passwd** command to modify his/her own password after the login has been activated.

Password is a case-sensitive string of alphanumeric and symbolic characters. Password may have a minimum of six and a maximum of ten characters. Additionally, the password must include at least two numeric characters and one symbolic (non-alphabetic and non-numeric) character. The following symbolic characters have special meanings either for the User Interface or for the X.25 TL1 interface and cannot be included in a password:

;	semicolon		space
@	at sign	*?*	question mark
\	back slash	*!*	exclamation point
:	colon	*=*	equal sign
"	double quote	,	comma

Additionally, the following control characters and special keys CANNOT be included in a password:

<CR>	carriage return	*<tab>*	tab key
<bksp>	backspace key	*<esc>*	escape key
<del>	delete key		

edit Change an existing login and/or password

delete Delete an existing login.

The **set-lgn** command executes in prompt mode. Based on the action selected, there are three different dialogs shown on the following pages. In these dialogs, the user input is indicated with bold type.

The following screen shows the dialog to enter a login:

```
set-lgn:act=enter;
enter the new login = new_login
enter password for new login = new_password
reenter password for new login = new_password
enter user type for this login = user_type

/* Caution! Network Element access is affected by this command.
   You have selected the set-lgn command with these parameters:

   Action = enter
   Login = new_login
   User Type = user_type */

Execute? (y/n or CANcel/DELete to quit) =
;
```

NOTE:
Passwords will not be displayed when they are entered.

The following screen shows the dialog to edit a login:

```
set-lgn:act=edit;
enter the login to be changed = old_login
enter the new login = new_login
enter password for new login = new_password
reenter password for new login = new_password
enter user type for this login = user_type

/* Caution! Network Element access is affected by this command.
   You have selected the set-lgn command with these parameters:

   Action = edit
   Old Login = old_login
   New Login = new_login
   Old User Type = user_type
   New User Type = user_type  */

Execute? (y/n or CANcel/DELete to quit) =
;
```

The following screen shows the dialog to delete a login:

```
set-lgn:act=delete;
enter the login to be deleted = user_login
/* Caution! Network Element access is affected by this command.
   You have selected the set-lgn command with these parameters:

   Action = delete
   Login = user_login  */

Execute? (y/n or CANcel/DELete to quit) =
;
```

If the login value does not match the valid login definition (syntactically incorrect), the following message will appear:

```
/* Entry does not follow rules for logins. */
/* Logins must be 5 to 10 alphabetic characters and/or numbers;
   characters allowed are A..Z, a..z and/or 0..9 */
```

The user may try once again to enter a login. If the user enters a login that does not match the valid login definition, the following denial message will be displayed:

```
IDEI
/* Input, Data Entry Invalid */
/* Entry does not follow rules for passwords and logins. */
```

If the entered password value does not match the valid password definition (syntactically incorrect), the following message will appear:

```
/* Entry does not follow rules for passwords. */
/* Passwords must be 6 to 10 characters, with at least 2 non
   alphabetic characters and additionally, at least 1 symbolic.
   Characters allowed are:  A..Z or a..z, 0..9, all symbolic
   characters, EXCEPT the following:

         ;   semicolon        ?   question mark
         @   at sign             space
         :   colon            =   equal sign
         "   double quote     ,   comma
         \   back slash       !   exclamation point

*/
```

The user may try once again to enter a password. If the user enters a password that does not match the valid password definition, the following denial message will be displayed:

```
IDEI
/* Input, Data Entry Invalid */
/* Entry does not follow rules for passwords and logins. */
```

Privileged user logins can be edited to change the login name, password, or both. However, privileged logins cannot be deleted. If an attempt is made to delete a privileged user login, the following denial message will be displayed:

```
SDNC
/* Status, Data Not Consistent */
/* Privileged user logins cannot be deleted. */
```

If an attempt is made to add a privileged user login, the following message will keep displaying until a valid user type (general, maintenance, or reports-only) is entered:

```
/* Not a valid response */
/* Select from: */
   1. general
   2. maintenance
   3. reports-only
enter user type for this login [general] =
```

When a user selects the `edit` or `delete` option for a login but the login entered does not exist, the following message will be displayed:

```
IIUS
/* Input, Invalid USer identifier */
/* login <value> is unknown. */
```

If a user invokes this command with **`Action`**=`enter` and the entered login matches the login definition (syntactically correct) but *also* matches an already existing valid login, the attempt will be denied and the following denial message will be displayed:

```
IIUS
/* Input, Invalid USer identifier */
/* login <value> is unknown. */
```

If a user attempts to enter another login when the maximum supported logins already exists, the following denial message will appear:

```
SLEM
/* Status, List, Exceeds Maximum */
/* Maximum number of logins already exists.
   Cannot enter another login. */
```

RELATED COMMANDS

rtrv-lgn

set-passwd

set-secu

NAME

set-link: Set CIT Link Configuration

INPUT FORMAT

set-link:pg=*pagelength*;

DESCRIPTION

This command sets the configuration of the current user's craft interface terminal (CIT) link.

The input parameter is:

pg PageLength is the vertical size of the displayed page in lines. The value may be an integer between 3 and 150 with a default of 24. If the page length is set to zero, no pager is used and system output is sent directly to the screen. The page length is set to the default value each time a new CIT session is started.

RELATED COMMANDS

rtrv-link

NAME

set-ne: Set Network Element

INPUT FORMAT

set-ne:tid=*TID*[,**shelf=***Shelf*][,**cort=***CO/RT*]
[,**idle=***IdleChannelSignal*];

DESCRIPTION

NOTE:
This command page describes the functionality of the **set-ne** command in OC-12 Release 7.0 and later OC-12 TARP releases.

This command sets the network element (NE) characteristics (parameters) of a DDM-2000.

NOTE:
If security is enabled on any CIT or DCC port on a shelf, then this command is available to privileged users only for all CIT or DCC ports on the shelf.

The input parameters are:

tid TID is a string of up to 20 characters, and may include upper- and lowercase letters, numbers, and the following characters: "-", "+", "%", "#", ".". Prior to the first use of this command, the initial value is **LT-DDM-2000**. The *TID* will be printed at the beginning of the output for all commands. For proper operation of TL1/X.25 OS interfaces, the *TID* must be unique for each NE.

NOTE 1:
Changing the TID (system name) does not change the network address, which is determined by the NSAP but does affect proper TL1 message reporting.

NOTE 2:
It is strongly recommended to change the default TIDs of all NEs in the subnetwork at systems startup.

CAUTION:
Changing the TID will cause all active TL1 logins to this NE to be dropped. New TL1 logins to this NE will have to be activated using the new TID value.

shelf Shelf is the numeric identification (1-8) of the system in a bay arrangement at a site. NEs at the same site must have unique Shelf settings. The Shelf parameter is used by the local CIT interface to identify which system to connect to the CIT. The default value is 1.

cort The CO/RT parameter for CO (Central Office) or RT (Remote Terminal) identifies the system as having characteristics of a CO or an RT. The values for CO/RT are `co` and `rt` with `rt` as the default value. The value of CO/RT controls the operation of the miscellaneous discretes, and the external fan control.

idle IdleChannelSignal determines whether or not an AIS or Unequipped signal should be inserted toward the SONET line in VT1.5 and STS-1 channels that are not cross-connected. The value may be one of the following:

`ais` STS-1 or VT1.5 AIS is inserted towards the SONET line from SONET interfaces (OLIUs and STS1Es) if the channel is not cross-connected or if a low-speed slot is not equipped but the function unit is STS-1 cross-connected.

`unequipped` The STS-1 or VT1.5 Unequipped signal is inserted towards the SONET line from SONET interfaces (OLIUs and STS1Es) if the channel is not cross-connected or if a low-speed slot is not equipped but the function unit is STS-1 cross-connected.

Some of these parameters are backed up on the TGS packs (tid, shelf, cort). Any attempt to provision any of these parameters with no TGS packs equipped will be denied with the following message:

```
SNVS
 /* Status, Not in Valid State */
 /* System must be equipped with at least one TGS circuit
    pack to provision selected parameters.  */
```

When this command is entered, the following confirmation message will be displayed:

```
/* Caution! Network Element access is affected by this command.

   You have selected the set-ne command with these parameters:

    TID = LT-DDM-2000
    IDLE = ais|unequipped
    Shelf = shelf

Execute? (y/n or CANcel/DELete to quit) =
```

Changing the **cort** or **shelf** parameters will cause the network element to reset. Before these parameters are changed, the following caution message will be displayed prior to the confirmation message:

```
/* Caution!  Network Element access is affected by this command.

   Caution! When executed, this command causes the NE to
   restart the program.  This action will erase all of
   the performance monitoring data and the history file.
   If possible, it will reinitialize the date and time with
   the far end via the DCC.  Otherwise, the
   date and time will assume default values.
   You have selected the set-ne command with these parameters:
```

RELATED COMMANDS

reset

rlgn

rtrv-ne

rtrv-map-network

NAME

set-oc3: Set OC-3 Characteristics

INPUT FORMAT

set-oc3:*Address*[:**dgr=***SignalDegradeThreshold*]
[,**syncmsg=***SynchronizationMessaging*][,**app=***Application*]
[,**aisalm=***Alarm*];

DESCRIPTION

This command sets several characteristics (parameters) of a specified OC-3 line or line pair. For OC-12 ring or linear applications, the address is expressed as a line pair.

The input parameters are:

Address Address identifies the OC-3 line(s) or line pair(s).

Valid Addresses: **fn-{a,b,c,d,all}, all**

dgr SignalDegradeThreshold specifies the signal degrade threshold as a BER in terms of a logarithm to the base 10. When this threshold is crossed, an alarm will be raised and automatic protection switching of the service line will be initiated. The value of this parameter has a range of -9 to -5. The default value is -6.

syncmsg Synchronization messaging allows timing to be reconfigured in a network upon a node or fiber failure. This parameter has one of the following values:

Kbyte This is the default value. When this option is selected, both K2 and S1 byte sync messages are transmitted, but only K2 byte is received and interpreted for sync messaging.

Sbyte When this option is selected, only the S1 byte is sent and received for sync messaging. K2 byte will always send a "Don't Use" message.

NOTE:
To minimize the amount of time that DDM-2000 is in holdover mode when upgrading a ring network from **Kbyte** to **Sbyte** messages, it is recommended that the user first upgrade the nodes farthest away from the external timing source, and then proceed to nodes closer to the timing source.

`disabled` When this option is selected, interpretation of both K2 and S1 bytes will be disabled and hence a "Don't Use" message will be transmitted on both bytes at all times.

`concat` This parameter is available in linear systems only. ConcatenationMode provisions the concatenation mode of the OC-3 line

`app` Application is a keyword that further characterizes the behavior of the function unit in complex networks. This parameter cannot be changed if any cross-connection exists to this function slot. Parameter value is one of the following:

`0x1` The function unit is part of an OC-12 dual or single-homed, 0x1 ring application. The automatic protection switching and alarms will follow the rules for the dual or single-homed 0x1 ring applications. For single-homed 0x1 ring applications, both **`fn`** slots must be equipped. For dual-homed 0x1 ring applications, one **`fn`** slot must be empty. **`0x1`** is the default value.

`1+1` The function unit is an optical extension of a path switched ring. The automatic protection switching and alarms will follow the rules for optical extension applications.

`video` There is no protection switching between the packs in a function unit pair. This option is used in conjunction with the video broadcast application.

`aisalm` Alarm is the provisioned alarm level of the NSA OC-3 line AIS and has the following values:

`cr` Critical alarm

`mj` Major alarm

`mn` Minor alarm

`na` Not alarmed, but reported (default).

The application parameter requires that no cross-connection exist to the addressed function unit if the application type is to be changed. If the port is cross-connected, the request will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* Cross-connection exists.  Application cannot be changed. */
```

If the Application parameter is used with **AID** = `all` and one or more addresses cannot be processed because of existing cross connections, the request will complete but the following message is displayed:

```
/* Following AIDs cannot be changed.
   Cross-connections already exist:

            address
            address
```

If an attempt is made to execute this command, when a mix of incompatible OLIU packs exists in Main, the request will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* Both main slots must be equipped with compatible OLIU packs. */
```

This command will cause the following confirmation request to be displayed:

```
/* Caution! Alarm or maint. thresholds and sync messages
   are affected by this command.
   You have selected the set-oc3 command with these parameters:

   Address = x
   SignalDegradeThreshold = -n
   SynchronizationMessaging = value
   NonServiceAffectingAIS= value
   ConcatenationMode = value
   Application = value */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

rtrv-oc3

rtrv-sync

NAME

set-oc12: Set OC-12 Characteristics

INPUT FORMAT

set-oc12:*Address*[:**dgr=***SignalDegrade*][,**syncmsg=***SynchronizationMessaging*] [,**aisalm=***Alarm*];

DESCRIPTION

This command sets the Signal Degrade (DGR) threshold, the line AIS alarm level and the K byte message status of the specified OC-12 line pair.

The input parameters are:

Address Address identifies the OC-12 line or line pair.

Valid OC-12 ring addresses: **main-b-{1,2,all}, all**

dgr SignalDegrade specifies the signal degrade threshold as a BER in terms of a logarithm to the base 10. The value of this parameter has a range of -5 to -9. The default value is -6. For ring releases, the degrade values for main-b-1 and main-b-2 must be the same. Any change to one address will also be made automatically to the other by the software.

syncmsg Synchronization messaging allows timing to be reconfigured in a network upon a node or fiber failure. Parameter value is one of the following:

- `Kbyte` This is the default value. When this option is selected, both K2 and S1 byte sync messages are transmitted, but only K2 byte is received and interpreted for sync messaging.
- `Sbyte` When this option is selected, only the S1 byte is sent and received for sync messaging. K2 byte will always send a "Don't Use" message.
- `disabled` When this option is selected, interpretation of both K2 and S1 bytes will be disabled and hence a "Don't Use" message will be transmitted on both bytes at all times.

aisalm For ring releases, the AIS alarm values for Main-b-1 and Main-b-2 must be the same. Any change to one address will also be made automatically to the other by the software. Alarm is the provisioned alarm level of the non-service affecting (NSA) OC-12 line AIS and has the following values:

`cr` Critical alarm

`mj` Major alarm

`mn` Minor alarm

`na` Not alarmed, but reported (default)

If an attempt is made to execute this command, when a mix of incompatible OLIU packs exists in Main, the request will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* Both main slots must be equipped with compatible OLIU packs. */
```

This command will cause the following confirmation request to be displayed:

```
/* Caution! Alarm or maint. thresholds are affected by this command.
    You have selected the set-oc12 command with these parameters:

      Address = x
      SignalDegradeThreshold = -n
      SynchronizationMessaging = x
      NonServiceAffectingAIS= value */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

rtrv-oc12

rtrv-sync

NAME

set-passwd: Set Password

INPUT FORMAT

set-passwd;

DESCRIPTION

This command changes a user's password. All users can change their own passwords. Privileged users can change other users' passwords by using the **set-lgn** command.

The following screen shows the dialog to change a password. In the dialog, the user input is shown in bold type.

NOTE:
Passwords will not be displayed when they are entered.

```
   <set-passwd;

enter your old password = old_password
enter your new password = new_password
reenter your new password = new_password
;
```

There are no default values for the old and new passwords.

A valid password is a case-sensitive ASCII string containing a minimum of six and a maximum of ten characters. The password must also include at least two numeric characters and one symbolic (non-alphabetic and non-numeric) character. The following symbolic characters have special meanings either for the User Interface or for the x.25 TL1 interface and cannot be included in a password:

;	semicolon	?	question mark
@	at sign		space
:	colon	=	equal sign
"	double quote	,	comma
\	back slash	!	exclamation point

Additionally, the following control characters and special keys CANNOT be included in a password:

<CR>	carriage return	<tab>	tab key
<bksp>	backspace key	<esc>	escape key
<del>	delete key		

If the entered password value does not match the valid password definition (syntactically incorrect), the following message will be displayed:

```
/* Entry does not follow rules for passwords. */
/* Passwords must be 6 to 10 characters, with at least 2 non
   alphabetic characters and additionally, at least 1 symbolic.
   Characters allowed are:  A..Z or a..z, 0..9, all symbolic
   characters, EXCEPT the following:

         ;   semicolon        ?   question mark
         @   at sign            space
         :   colon            =   equal sign
         "   double quote     ,   comma
         \   back slash       !   exclamation point

*/

enter your new password:
```

The user may try once again to enter a password. If the user tries again to enter a password that does not match the valid password definition, the following denial message will be displayed:

```
IDEI
/* Input, Data Entry Invalid */
/* Entry does not follow rules for passwords and logins. */
```

If a user is changing a password and the password entered does not match the present valid password, it will be rejected and the user will be prompted to try again. The user is allowed only one retry. If the user attempts and fails a second time, the entry will be denied with the following message and the old password will remain in effect:

```
PIPW
/* Privilege, Illegal PassWord. */
/* The old password remains in effect. */
```

If the new password that a user enters when changing a password meets the password definition requirements (syntactically correct), but does not match on its two entries (`enter your new password`; `reenter your new password`), the following message will be displayed:

```
/* The first and second entries of new password did not match. */
```

The user may try once again to change the password. If the user fails a second time to match the two entries, the following denial message will be displayed and the old password will remain in effect:

```
IDNC
/* Input, Data Not Consistent */
/* First and second entries of new password did not match.
   The old password remains in effect. */
```

RELATED COMMANDS

rtrv-lgn

set-lgn

set-secu

NAME

set-pmthres-line: Set Performance Monitoring Threshold Line

INPUT FORMAT

set-pmthres-line:
[**QHB2CVOC12=***nnnnn*][,**DayB2CVOC12=***nnnnnn*]
[,**QHB2CVOC3=***nnnnn*][,**DayB2CVOC3=***nnnnnnn*]
[,**QHB2CVEC1=***nnnn*][,**DayB2CVEC1=***nnnnn*]
[,**QHB2ES=***nnn*][,**DayB2ES=***nnnnn*]
[,**QHB2ESA=***nnn*][,**DayB2ESA=***nnnnn*]
[,**QHB2ESB=***nnn*][,**DayB2ESB=***nnnnn*]
[,**QHB2SES=***nn*][,**DayB2SES=***nnnn*]
[,**QHB2UAS=***nn*][,**DayB2UAS=***nnnn*]
[,**QHPSCL=***nn*][,**DayPSCL=***nn*]**;**

where *nnn...* is a numerical value in the range given in the following parameter descriptions.

NOTE:
Parameters are shown in uppercase letters for readability. Parameters may be entered in either upper- or lowercase letters.

DESCRIPTION

This command sets the performance parameter thresholds of OC-3 or OC-12 lines and activates and deactivates the processing of threshold crossings for performance parameters.

Entering a value of zero (0) for a parameter will disable thresholding for that parameter.

The input parameters are:

QHB2CVOC12 This parameter sets the threshold for the OC-12 coding violations count on a quarter-hourly basis. This parameter has a range of -10 through -7, corresponding to BERs of 10^{-10} through 10^{-7}, and an integer range of 0 through 55365. The default value is 5537. A negative value of this parameter indicates that the parity count threshold is specified in terms of an equivalent BER expressed as a logarithm to the base 10.

DayB2CVOC12 A positive value of this parameter sets the threshold for the OC-12 coding violation count on a daily basis. This parameter has a range of -10 through -7, corresponding to BERs of 10^{-10} through 10^{-7}, and an integer range of 0 through 5315040. The default value is 531504. A negative value of this parameter sets the parity count

threshold in terms of an equivalent BER expressed as a logarithm to the base 10.

QHB2CVOC3 This parameter sets the threshold for the OC-3 coding violations count on a quarter-hourly basis. This parameter has a range of -10 through -7, corresponding to BERs of 10^{-10} through 10^{-7}, and an integer range of 0 through 13841. The default value is 1384. A negative value of this parameter indicates that the parity count threshold is specified in terms of an equivalent BER expressed as a logarithm to the base 10.

DayB2CVOC3 A positive value of this parameter sets the threshold for the OC-3 coding violation count on a daily basis. This parameter has a range of -10 through -7, corresponding to BERs of 10^{-10} through 10^{-7}, and an integer range of 0 through 1328736. The default value is 132874. A negative value of this parameter sets the parity count threshold in terms of an equivalent BER expressed as a logarithm to the base 10.

QHB2CVEC1 This parameter sets the threshold for EC-1 coding violation counts on a quarter-hourly basis.

DayB2CVEC1 This parameter sets the threshold for EC-1 coding violation counts on a daily basis.

QHB2ES This parameter sets the threshold for the ES type A count on a quarter-hourly basis. This parameter is an integer with range 0 through 900 and a default value of 40.

DayB2ES This parameter sets the threshold for the ES type A count on a daily basis. This parameter is an integer with range 0 through 65535 and default value of 900.

QHB2ESA This parameter sets the threshold for the ES type A count on a quarter-hourly basis. This parameter is an integer with range 0 through 900 and default value of 30.

DayB2ESA This parameter sets the threshold for the ES type A count on a daily basis. This parameter is an integer with range 0 through 65535 and default value of 90.

QHB2ESB This parameter sets the threshold for the ES type B count on a quarter-hourly basis. This parameter is an integer with range 0 through 900 and default value of 30.

DayB2ESB This parameter sets the threshold for the ES type B count on a daily basis. This parameter is an integer with range 0 through 65535 and default value of 90.

QHB2SES This parameter sets the threshold for the SES count on a quarter-hourly basis. This parameter is an integer with range 0 through 63 and default value of 20.

DayB2SES This parameter sets the threshold for the SES count on a daily basis. This parameter is an integer with range 0 through 4095 and default value of 60.

QHB2UAS This parameter sets the threshold for the UAS count on a quarter-hourly basis. This parameter is an integer with range 0 through 63 and default value of 30.

DayB2UAS This parameter sets the threshold for the UAS count on a daily basis. This parameter is an integer with range 0 through 4095 and default value of 90.

QHPSCL This parameter sets the threshold for the line protection switch counts on a quarter-hourly basis. This parameter is an integer with range 0 through 63 and default value of 2.

DayPSCL This parameter sets the threshold for the line protection switch counts on a daily basis. This parameter is an integer with range 0 through 255 and default value of 4.

The following tables show the error counts equivalent to different BER thresholds for OC-12, OC-3, and EC-1.

B2 OC12 Line Errors

BER Threshold	Equivalent 15 Min. Threshold (QHB2CVOC12)	Equivalent Day Threshold (DayB2CVOC12)
-7	55364	5315052
-8	5537	531505
-9	554	53151
-10	55	5315

B2 OC3 Line Errors

BER Threshold	Equivalent 15 Min. Threshold (QHB2CVOC3)	Equivalent Day Threshold (DayB2CVOC3)
-7	13841	1328736
-8	1384	132874
-9	138	13287
-10	14	1329

B2 EC1 Line Errors

BER Threshold	Equivalent 15 Min. Threshold (QHB2CVEC1)	Equivalent Day Threshold (DayB2CVEC1)
-7	4613	442848
-8	461	44285
-9	46	4428
-10	5	443

RELATED COMMANDS

init-pm

rtrv-pm-line

rtrv-pm-tca

rtrv-pmthres-line

set-pmthres-sect

NAME

set-pmthres-sect: Set Performance Monitoring Threshold Section

INPUT FORMAT

set-pmthres-sect:[**TxPwr1dB=***n*][,**TxPwr2dB=***n*][,**LaserBias=***n*]
[,**Qhsefs=***nn*][,**Daysefs=***nnnn*];

DESCRIPTION

This command sets the performance-monitoring thresholds of an OC-12 and OC-3 sections, as well as activating and deactivating the processing of threshold crossings for performance parameters.

The input parameters are:

TxPwr1dB This parameter enables/disables the -1 dB threshold for optical transmit power. The valid values are **enabled** (default value) and **disabled**. This parameter applies only to the 21G OLIU circuit pack.

TxPwr2dB This parameter enables/disables the -2 dB threshold for optical transmit power. The valid values are **enabled** (default value) and **disabled**. This parameter applies only to the 21G OLIU circuit pack.

LaserBias This parameter enables/disables the laser bias threshold. The valid values are **enabled** (default value) and **disabled**. This parameter applies only to the 21G, 23G, 23H and 23R OLIU circuit packs.

Qhsefs This parameter sets the threshold for SEFS on a quarter-hourly basis. This parameter is an integer with range of 0 through 63 and default value of 10. Entering a parameter value of zero (0) will disable thresholding for this parameter.

Daysefs This parameter sets the threshold for SEFS on a daily basis. This parameter is an integer with range of 0 through 4095 and a default value of 30. Entering a parameter value of zero (0) will disable thresholding for this parameter.

RELATED COMMANDS

init-pm

rtrv-pm-sect

rtrv-pm-tca

rtrv-pmthres-sect

NAME

set-pmthres-sts1: Set Performance Monitoring Threshold STS-1

INPUT FORMAT

set-pmthres-sts1:[**QHB3CV=***nnnn*][,**DayB3CV=***nnnnnn*][,**QHB3ES=***nnn*]
[,**DayB3ES=***nnnnn*][,**QHB3ESA=***nnn*][,**DayB3ESA=***nnnnn*][,**QHB3ESB=***nnn*]
[,**DayB3ESB=***nnnnn*][,**QHB3SES=***nn*][,**DayB3SES=***nnnn*][,**QHB3UAS=***nn*]
[,**DayB3UAS=***nnnn*];

where *nnn...* is the numerical value given in the following parameter descriptions.

NOTE:
Parameters are shown in upper-case letters for readability. Parameters may be entered in either upper- or lower-case letters.

DESCRIPTION

This command provisions STS-1 path performance parameter thresholds as well as enabling and disabling the processing of threshold crossings for the various parameters. Entering a parameter value of zero (0) will disable thresholding for that parameter.

The input parameters are:

QHB3CV This parameter sets the threshold for the coding violations count on a quarter-hourly basis. A negative value of this parameter indicates that the parity count threshold is specified in terms of an equivalent BER expressed as a logarithm to the base 10. This parameter has a range of -10 through -7, corresponding to BERs of 10^{-10} through 10^{-7}, and an integer range of 0 through 4510. The default value is 451.

DayB3CV This parameter sets the threshold for the coding violations count on a daily basis. A negative value of this parameter indicates that the parity count threshold is specified in terms of an equivalent BER expressed as a logarithm to the base 10. This parameter has a range of -10 through -7, corresponding to BERs of 10^{-10} through 10^{-7}, and an integer range of 0 through 432960. The default value is 43296.

QHB3ES This parameter sets the threshold for errored seconds on a quarter-hourly basis. This parameter has an integer range of 0 through 900 and a default value of 40.

DayB3ES This parameter sets the threshold for errored seconds on a daily basis. This parameter has an integer range of 0 through 65535 and a default value of 900.

QHB3ESA This parameter sets the threshold for type A errored seconds on a quarter-hourly basis. A type A ES is a second with a single error. This parameter has an integer range of 0 through 900 and a default value of 30.

DayB3ESA This parameter sets the threshold for type A errored seconds on a daily basis. A type A ES is a second with a single error. This parameter has an integer range of 0 through 65535 and a default value of 90.

QHB3ESB This parameter sets the threshold for type B errored seconds on a quarter-hourly basis. A type B ES is a second with more than one error, but less than the number of errors in a severely errored second. This parameter has an integer range of 0 through 900 and a default value of 30.

DayB3ESB This parameter sets the threshold for type B errored seconds on a daily basis. A type B ES is a second with more than one error, but less than the number of errors in a severely errored second. This parameter has an integer range of 0 through 65535 and a default value of 90.

QHB3SES This parameter sets the threshold for the severely errored frame seconds count on a quarter-hourly basis. This parameter has an integer range of 0 through 63 and a default value of 20.

DayB3SES This parameter sets the threshold for the severely errored frame seconds count on a daily basis. This parameter has an integer range of 0 through 4095 and a default value of 60.

QHB3UAS This parameter sets the threshold for unavailable seconds on a quarter-hourly basis. This parameter has an integer range of 0 through 63 and a default value of 30.

DayB3UAS This parameter sets the threshold for unavailable seconds on a daily basis. This parameter has an integer range of 0 through 4095 and a default value of 90.

The following table shows the error counts equivalent to different BER thresholds.

B3 STS-1 Path Errors

BER Threshold	Equivalent 15 Min. Threshold (QHB3CV)	Equivalent Day Threshold (DayB3CV)
-7	4510	432960
-8	451	43296
-9	45	4330
-10	5	433

RELATED COMMANDS

init-pm

rtrv-pmthres-sts1

rtrv-pm-sts1

rtrv-pm-tca

NAME

set-pmthres-t3: Set Performance Monitoring Threshold T3

INPUT FORMAT

set-pmthres-t3:[**QHCVL=***nnnnn*][,**DayCVL=***nnnnnnn*][,**QHESL=***nnn*]
[,**DayESL=***nnnnn*][,**QHSESL=***nn*][,**DaySESL=***nnnn*][,**QHSEFS=***nn*]
[,**DaySEFS=***nnnn*][,**QHPCV=***nnnnn*][,**DayPCV=***nnnnnnn*]
[,**QHFMCV=***nnnnn*][,**DayFMCV=***nnnnnnn*][,**QHCP=***nnnnn*][,**DayCP=***nnnnnnn*]
[,**QHESP=***nnn*][,**DayESP=***nnnnn*][,**QHSESP=***nn*][,**DaySESP=***nnnn*]
[,**QHUASP=***nn*][,**DayUASP=***nnnn*][,**QHSEFSFE=***nn*][,**DaySEFSFE=***nnnn*]
[,**QHCPFE=***nnnnn*][,**DayCPFE=***nnnnnnn*][,**QHESPFE=***nnn*][,**DayESPFE=***nnnnn*]
[,**QHSESPFE=***nn*][,**DaySESPFE=***nnnn*][,**QHUASPFE=***nn*][,**DayUASPFE=***nnnn*];

NOTE:
All DS3 line parameters (in addition to DS3 C-bit parity and all other path parameters for the incoming signal from the DSX-3) are only applicable when a BBG11B pack is active (in-service) in a function unit slot.

where *nnn. . . .* is a numerical value in the range given in the parameter description listed below.

NOTE:
Parameters are shown in upper-case letters for readability. Parameters may be entered in either upper- or lower-case letters.

DESCRIPTION

This command sets the performance parameter thresholds of a DS3 signal as well as activating and deactivating the processing of threshold crossings for error performance parameters. Entering a value of zero (0) for a parameter will disable thresholding for that parameter.

The input parameters are:

QHCVL This parameter sets the threshold for the coding violations count on a quarter-hourly basis for the DS3 line B3ZS data. A negative value for this parameter indicates that the threshold is specified in terms of an equivalent BER expressed as a logarithm to the base 10. This parameter has a range of -10 through -7, corresponding to BERs of 10^{-10} through 10^{-7}, and an integer range of 0 through 16383. The default value is 40.

DayCVL This parameter sets the threshold for the coding violations count on a daily basis for the DS3 line B3ZS data. A negative value for this parameter indicates that the threshold is specified in terms of an equivalent BER expressed as a logarithm to the base 10. This parameter has a range of -10 through -7, corresponding to BERs of 10^{-10} through 10^{-7}, and an integer range of 0 through 1048575. The default value is 3865.

QHESL This parameter sets the threshold for the errored seconds count on a quarter-hourly basis for the DS3 line with at least one B3ZS coding violation. This parameter has an integer range of 0 through 900 with a default value of 25.

DayESL This parameter sets the threshold for the errored seconds count on a daily basis for the DS3 line with at least one B3ZS coding violation. This parameter has an integer range of 0 through 65535 with a default value of 250.

QHSESL This parameter sets the threshold for the severely errored seconds count on a quarter-hourly basis for the DS3 line with greater than 44 B3ZS coding violations. This parameter has an integer range of 0 through 63 with a default value of 4.

DaySESL This parameter sets the threshold for the severely errored seconds count on a daily basis for the DS3 line with greater than 44 B3ZS coding violations. This parameter has an integer range of 0 through 4095 with a default value of 40.

QHSEFS This parameter sets the threshold for the severely errored frame seconds count on a quarter-hourly basis. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. This parameter has an integer range of 0 through 63 with a default value of 2.

DaySEFS This parameter sets the threshold for the severely errored frame seconds count on a daily basis. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. This parameter has an integer range of 0 through 4095 with a default value of 8.

QHPCV This parameter sets the threshold for the coding violations count on a quarter-hourly basis for the **pbit** type of format. The type is selected using the **set-t3** command. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. A negative value of this parameter indicates that the parity count threshold is specified in terms of an equivalent BER expressed as a logarithm to the base 10. This parameter has a range of -10 through -7, corresponding to BERs of 10^{-10} through 10^{-7}, and an integer range of 0 through 16383. The default value is 40.

DayPCV This parameter sets the threshold for the coding violations count on a daily basis for the **pbit** type of format. The type is selected using the **set-t3** command. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. A negative value of this parameter indicates that the parity count threshold is specified in terms of an equivalent BER expressed as a logarithm to the base 10. This parameter has a range of -10 through -7, corresponding to BERs of 10^{-10} through 10^{-7}, and an integer range of 0 through 1048575. The default value is 3820.

QHFMCV This parameter sets the threshold for the coding violations count on a quarter-hourly basis for the **fmbit** type of format. The type is selected using the **set-t3** command. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. A negative value of this parameter indicates that the parity count threshold is specified in terms of an equivalent BER expressed as a logarithm to the base 10. This parameter has a range of -10 through -7, corresponding to BERs of 10^{-10} through 10^{-7}, and an integer range of 0 through 16383. The default value is 40.

DayFMCV This parameter sets the threshold for the coding violations count on a daily basis for the **fmbit** type of format. The type is selected using the **set-t3** command. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. A negative value of this parameter indicates that the parity count threshold is specified in terms of an equivalent BER expressed as a logarithm to the base 10. This parameter has a range of -10 through -7, corresponding to BERs of 10^{-10} through 10^{-7}, and an integer range of 0 through 1048575. The default value is 3820.

QHCP This parameter sets the threshold for the coding violations count on a quarter-hourly basis for the near-end **cpbit** type of format. The type is selected using the **set-t3** command. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. A negative value of this parameter indicates that the parity count threshold is specified in terms of an equivalent BER expressed as a logarithm to the base 10. This parameter has a range of -10 through -7, corresponding to BERs of 10^{-10} through 10^{-7}, and an integer range of 0 through 16383. The default value is 40.

DayCP This parameter sets the threshold for the coding violations count on a daily basis for the near-end **cpbit** type of format. The type is selected using the **set-t3** command. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. A negative value of this parameter indicates that the parity count threshold is specified in terms of an equivalent BER expressed as a logarithm to the base 10. This

parameter has a range of -10 through -7, corresponding to BERs of 10^{-10} through 10^{-7}, and an integer range of 0 through 1048575. The default value is 3820.

QHESP This parameter sets the threshold for the errored seconds count on a quarter-hourly basis for **pbit**, **fmbit**, and **cpbit** type of formats. The type is selected using the **set-t3** command. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. This parameter has an integer range of 0 through 900, with a default value of 25.

DayESP This parameter sets the threshold for the errored seconds count on a daily basis for **pbit**, **fmbit**, and **cpbit** type of formats. The type is selected using the **set-t3** command. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. This parameter has an integer range of 0 through 65535 with a default value of 250.

QHSESP This parameter sets the threshold for the severely errored seconds count on a quarter-hourly basis for **pbit**, **fmbit**, and **cpbit** type of formats. The type is selected using the **set-t3** command. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. This parameter has an integer range of 0 through 63 with a default value of 4.

DaySESP This parameter sets the threshold for the severely errored seconds count on a daily basis for **pbit**, **fmbit**, and **cpbit** type of formats. The type is selected using the **set-t3** command. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. This parameter has an integer range of 0 through 4095, with a default value of 40.

QHUASP This parameter sets the threshold for the unavailable seconds count on a quarter-hourly basis for **pbit**, **fmbit**, and **cpbit** type of formats. The type is selected using the **set-t3** command. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. This parameter has an integer range of 0 through 63 with a default value of 10.

DayUASP This parameter sets the threshold for the unavailable seconds count on a daily basis for **pbit**, **fmbit**, and **cpbit** type of formats. The type is selected using the **set-t3** command. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. This parameter has an integer range of 0 through 4095 with a default value of 10.

QHSEFSFE This parameter sets the threshold for the severely errored frame seconds count on a quarter-hourly basis for the far-end **cpbit** type of format. The type is selected using the **set-t3** command. This parameter is monitored by reading the received X-bits in the DS3 C-bit parity frame. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. This

parameter has an integer range of 0 through 63 with a default value of 2.

DaySEFSFE This parameter sets the threshold for the severely errored frame seconds count on a daily basis for the far-end **cpbit** type of format. The type is selected using the **set-t3** command. This parameter is monitored by reading the received X-bits in the DS3 C-bit parity frame. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. This parameter has an integer range of 0 through 4095, with a default value of 8.

QHCPFE This parameter sets the threshold for the coding violations count on a quarter-hourly basis for the far-end **cpbit** type of format. The type is selected using the **set-t3** command. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. A negative value of this parameter indicates that the parity count threshold is specified in terms of an equivalent BER expressed as a logarithm to the base 10. This parameter has a range of -10 through -7, corresponding to BERs of 10^{-10} through 10^{-7}, and an integer range of 0 through 16383. The default value is 40.

DayCPFE This parameter sets the threshold for the coding violations count on a daily basis for the far-end **cpbit** type of format. The type is selected using the **set-t3** command. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. A negative value of this parameter indicates that the parity count threshold is specified in terms of an equivalent BER expressed as a logarithm to the base 10. This parameter has a range of -10 through -7, corresponding to BERs of 10^{-10} through 10^{-7}, and an integer range of 0 through 1048575. The default value is 3820.

QHESPFE This parameter sets the threshold for the errored seconds count on a quarter-hourly basis for the far-end **cpbit** type of format. The type is selected using the **set-t3** command. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. This parameter has an integer range of 0 through 900 with a default value of 25.

DayESPFE This parameter sets the threshold for the errored seconds count on a daily basis for the far-end **cpbit** type of format. The type is selected using the **set-t3** command. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. This parameter has an integer range of 0 through 65535 with a default value of 250.

QHSESPFE This parameter sets the threshold for the severely errored seconds count on a quarter-hourly basis for the far-end **cpbit** type of format. The type is selected using the **set-t3** command. This is a path parameter that applies to the incoming DS3 signal

from both the DSX-3 and the fiber. This parameter has an integer range of 0 through 63 with a default value of 4.

DaySESPFE This parameter sets the threshold for the severely errored seconds count on a daily basis for the far-end **cpbit** type of format. The type is selected using the **set-t3** command. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. This parameter has an integer range of 0 through 4095 with a default value of 40.

QHUASPFE This parameter sets the threshold for the unavailable seconds count on a quarter-hourly basis for the far-end **cpbit** type of format. The type is selected using the **set-t3** command. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. This parameter has an integer range of 0 through 63 with a default value of 10.

DayUASPFE This parameter sets the threshold for the unavailable seconds count on a daily basis for the far-end **cpbit** type of format. The type is selected using the **set-t3** command. This is a path parameter that applies to the incoming DS3 signal from both the DSX-3 and the fiber. This parameter has an integer range of 0 through 4095 with a default value of 10.

The following table shows the error counts equivalent to different BER thresholds.

DS3 P-bit, F&M bit, and C-bit Coding Violations

BER Threshold	Equivalent 15 Min. Threshold (**QHCV**)	Equivalent Day Threshold (**DayCV**)
-7	3979	381972
-8	398	38197
-9	40	3820
-10	4	382

DS3 Line Coding Violations

BER Threshold	Equivalent 15 Min. Threshold (**QHCVL**)	Equivalent Day Threshold (**DayCVL**)
-7	4026	386519
-8	402	38651
-9	40	3865
-10	4	386

RELATED COMMANDS

init-pm

rtrv-pm-t3

rtrv-pm-tca

rtrv-pmthres-t3

set-t3

NAME

set-secu: Set Security

INPUT FORMAT

`set-secu`:*`Address`*[:**`sec=`***`Security`*][,**`to=`***`Timeout`*];

DESCRIPTION

This command configures network element (NE) system security on each CIT and DCC interface.

The three default logins are `LUC01`, `LUC02`, and `LUC03` (all upper-case letters). The default password is `DDM-2000`. Privileged users should change these defaults before enabling security or setting security to a lockout state.

NOTE:
This command is available to privileged users only.

The input parameters are:

`address` Address is the address of one or more CIT and/or DCC ports. There is no default address.

Valid Addresses: **`dcc-all, cit-{1,2,all}`**

`sec` Security determines whether security is enabled, disabled, or in lockout state on the specified CIT and DCC port(s). Enabling security requires users to enter a valid login and password pair to access the system via the specified CIT or DCC-all.

The values for this parameter are **`enabled`**, **`disabled`** (default value), and **`lockout`**.

When security is in lockout state, the only user type permitted to access the system through the locked out CIT/DCC port is a privileged user; all non-privileged users, even with a valid login and password pair, are not allowed to access the system.

NOTE:
When security is in the lockout state, non-privileged users are not deleted from the login/password database, but are simply blocked from accessing the system. Existing Iactive login sessions initiated by non-privileged users are not affected (that is, not dropped) if security is set to **`lockout`**.

to Timeout specifies the time, in minutes, before an inactive session is automatically terminated. This has a value ranging from 0 to 120 minutes and a default value of 15 minutes. Setting this parameter to 0 will disable the timeout function.

Execution of this command affects all subsequent attempts to establish login sessions but does not affect currently active sessions.

When security is enabled, the following four types of users are permitted to access the system with a valid login and password:

`privileged` The privileged user may execute any commands, including restricted commands.

`general` The general user may execute any commands not restricted to privileged users.

`maintenance` The maintenance user may only execute commands that access the system, extract reports, and execute maintenance functions through a specific set of commands. This user may not execute any privileged commands.

`reports-only` The reports-only user may only execute commands that extract reports from the system and several other basic commands.

When security is enabled on a system, only the following commands may be executed by reports-only users:

- **?** (help)
- **logout** (logout)
- **rlgn** (remote login)
- **set-passwd** (set password)
- **set-link** (set link)
- **^T** (toggle)
- all **rtrv** commands except **rtrv-lgn** and **rtrv-passwd**.

In addition to **set-secu**, the commands **init-sys**, **rtrv-lgn**, **set-fecom**, **set-feat**, **set-lgn**, **set-sync**, **rtrv-passwd**, and **rstr-passwd** are restricted to privileged users only. The following commands also become restricted to privileged users only when security is enabled on a system:

- **cpy-prog** (copy program)
- **dlt-tadrmap** (delete TID address map)

- **ent-ulsdcc** (enter upper layer section DCC)
- **init-pm** (initialize performance-monitoring)
- **ins-prog** (install program)
- **reset** (reset system software)
- **set-date** (set date)
- **set-ne** (set network element)
- **ent-tl1msgmap** (enter TL1 message map)
- **set-x25** (set X.25 link)
- **ent-osacmap** (enter OS application context id map)
- **dlt-osacmap** (delete OS application context id map)

Entering this command will cause the following confirmation message to be displayed:

```
/* Caution!  Network Element access is affected by this command.
   You have selected the set-secu command with these parameters:

   Address = address
   Security = security
   Timeout = n */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

rtrv-lgn

rtrv-secu

set-fecom

set-lgn

NAME

set-state-ec1: Set EC-1 Port State

INPUT FORMAT

set-state-ec1:*Address*:**ps=***PrimaryState*;

DESCRIPTION

This command sets the state of the low speed EC-1 ports. This command is used to turn on and off the monitoring of signal failures from a specified port.

The input parameters are:

Address Address identifies the EC-1 port(s).

Valid Addresses: **all, {a,b,c,d}-{1-3,all}**

ps PrimaryState is the port state which may have one of the following values:

- **auto** Set state to be monitored for good signal at the specified port.
- **nmon** Set memory state to not monitored.

NOTE:
If a port is in the **nmon** state, it must be returned to the **auto** state, using this command, before any circuit packs associated with that port can be removed from the equipment list by the **upd** command.

If a primary state of **nmon** is entered, the following message will be displayed:

```
/*  Port(s) address will not be monitored or alarmed in this state */
```

If this command is entered with several addresses and one or more of these addresses is not properly equipped, the following message will be displayed:

```
/* Address not equipped properly -- provisioning unchanged. */
```

If this command is executed and an STS-1 cross-connection exists for the address entered, the cross-connection must be cross-connected to an OLIU. If no OLIU is present, the following denial message will be displayed:

```
EQWT
/* EQuipage, Wrong Type */
/* STS1E must be cross-connected to OLIU */
```

The following confirmation message will be displayed after command entry:

```
/* Caution!  Alarm or maint. thresholds are affected by this command.
   You have selected set-state-ec1 command with these parameters:

   Address = x
   PrimaryState = x  */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

rtrv-ec1

rtrv-state

rtrv-state-eqpt

NAME

set-state-oc3: Set OC-3 Line State

INPUT FORMAT

set-state-oc3:*Address*:**ps=***PrimaryState*;

DESCRIPTION

This command sets the state of one or more OC-3 lines. This command is used to turn on and off the monitoring of signal failures from a specified line.

The input parameters are:

Address Address identifies the OC-3 line(s).
Valid addresses:
fn-all, fn-{a,b,c,d}-{1,2,all}

ps PrimaryState is the line state which may have one of the following values:

- **nmon** Set the line state to not monitored. Do not report alarm or status conditions for the line. Section and line performance monitoring data collection will be stopped in this state. Do not change the line state to in-service if a good signal is detected. The line will remain in this state until the state is changed again with this command. DCC status is still monitored and reported in this state. To disable DCC, the **set-fecom** command is used.
- **is** Set the line state to be monitored for good signal at the specified line. Reporting of alarm, status conditions, and PMON data is in normal state.

If a line state of **nmon** is entered, the following message will be displayed:

```
/* Line(s) address will not be monitored or alarmed in
   this state */
```

The following confirmation message will be displayed after command entry:

```
/* Caution!  Alarm or maint. thresholds are affected by this command.
   You have selected the set-state-oc3 command with these parameters:

   Address = x
   PrimaryState =x */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

rtrv-state-eqpt

rtrv-state-oc3

upd

set-fecom

NAME

set-state-sts1: Set State of STS-1 Channels

INPUT FORMAT

set-state-sts1:*Address*:**ps=***PrimaryState*;

DESCRIPTION

This command sets the states of STS-1 channels. It is used to turn on and off the monitoring of signal failures and maintenance signals for specified channels.

The input parameters are:

Address Address identifies the STS-1 channel(s). Valid addresses are:

If the shelf is equipped with 24-type OLIU circuit packs in its Main unit slots, valid Main unit Addresses are:

all,m-{1-12,all}
all, {mb}-{1-12,all}
{a,b,c,d}-{1-3,all}.

Channel states can be set for:

- STS-1 channels within OC-12 interfaces that are cross-connected to DS3, interfaces
- STS-1 channels that are dropped from an OC-3 shelf equipped with 24-type OLIUs in its Main unit slots OC-12 ring interface to an OC-3, EC-1, or DS3 interface

ps PrimaryState is the channel state which may have one of the following values:

auto Set the channel state to automatic. Monitor the channel, but do not report alarm or status conditions. When a good signal is detected, automatically change the channel state to in-service and begin normal reporting of alarm and status conditions.

nmon Set the channel state to not monitored. Do not report alarm or status conditions for the channel. Do not change the channel state to in-service if a good signal is detected. The channel will remain in this state until the state is changed again with this command or until the cross-connection involving this channel is deleted.

If a primary state of **nmon** is entered, the following message will be displayed:

```
/*  Channel(s) address will not be monitored or
    alarmed in this state */
```

If the path address specified in the command is an STS-1 channel that is part of an STS-3c cross-connected channel, the command will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* The specified path is not properly cross-connected. */
```

The following confirmation message will be displayed after the command entry:

```
/* Caution!  Alarm or maint. thresholds are affected by this command.
   You have selected set-state-sts1 command with these parameters:

   Address = x
   PrimaryState = x  */

Execute? (y/n or CANcel/DELete to quit) =
```

If an attempt is made to execute this command when a mix of incompatible OLIU packs exists in Main, the request will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* Both main slots must be equipped with compatible OLIU packs. */
```

NOTE:
If an STS-1 address of **all** is provisioned, this command will skip silently all STS-1 channels that are cross-connected as passthrough, dropped not terminated, or not cross-connected at all.

RELATED COMMANDS

ent-crs-sts1

dlt-crs-sts1

rtrv-crs-sts1

rtrv-state-sts1

upd

NAME

set-state-sts3c: Set State of STS-3c Channels

INPUT FORMAT

set-state-sts3c:*Address*:**ps=***PrimaryState*;

DESCRIPTION

This command sets the states of STS-3c channels. It is used to turn on and off the monitoring of signal failures and maintenance signals for specified channels.

This command is available in OC-12 ring releases.

The input parameters are:

Address Address identifies the STS-3c channel(s).
Valid addresses are: **{mb}-{1,4,7,10,all}**.

Channel states can be set for STS-3c channels that are dropped (non-terminated) from an OC-12 high speed interface to OC-3c interfaces in the function unit slots.

ps PrimaryState is the channel state which may have one of the following values:

- **auto** Set the channel state to automatic. Monitor the channel, but do not report alarm or status conditions. When a good signal is detected, automatically change the channel state to in-service and begin normal reporting of alarm and status conditions.
- **nmon** Set the channel state to not monitored. Do not report alarm or status conditions for the channel. Do not change the channel state to in-service if a good signal is detected. The channel will remain in this state until the state is changed again with this command or until the cross-connection involving this channel is deleted (ring releases).

If a primary state of **nmon** is entered, the following message will be displayed:

```
/*  Channel(s) address will not be monitored or
    alarmed in this state */
```

If the path address specified in the command is an STS-1 cross-connected channel, or is a video or 0X1 STS-3c cross-connected channel, the command will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* The specified path is not properly cross-connected. */
```

The following confirmation message will be displayed after command entry:

```
/* You have selected set-state-sts3c command with these parameters:

   Address = x
   PrimaryState = x  */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

dlt-crs-sts3c

ent-crs-sts3c

rtrv-crs-sts3c

rtrv-state-sts3c

update

NAME

set-state-t3: Set T3 Port State

INPUT FORMAT

set-state-t3:*Address*:**ps=***PrimaryState*;

DESCRIPTION

This command sets the state of one or more DS3 ports. This command is used to turn on and off the alarm due to signal failures from a specified port.

The input parameters are:

Address Address identifies the DS3 port(s).

Valid DS3 Port Addresses: **{a,b,c,d}-{1-3,all},all**

ps PrimaryState is the port state which may have one of the following values:

- **auto** Set state to be monitored for good signal at the specified port.
- **nmon** Set memory state to not-alarmed.

NOTE:
If a port is in the **nmon** state, it must be returned to the **auto** state, using this command, before any circuit packs associated with that port can be removed from the equipment list by the **update** command.

If a port state of **nmon** is entered, the following message will be displayed:

```
/*  Port(s) address will not be alarmed in this state */
```

The following confirmation message will be displayed after command entry:

```
/* Caution!  Alarm or maint. thresholds are affected by this command.
   You have selected the set-state-t3 command with these parameters:

   Address = x
   PrimaryState =x */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

rtrv-state

rtrv-t3

upd

NAME

set-sts1: Set STS-1 Characteristics

INPUT FORMAT

set-sts1:*Address*:**dgr=***SignalDegrade*[,**nsa=***Alarm*][,**sa=***Alarm*];

DESCRIPTION

This command provisions the following three types of parameters for STS-1 channels:

Signal Degrade Alarm Threshold:
This parameter is only provisioned for ring channels (for example, incoming STS-1 channels on optical linear extensions in ring systems are not monitored). Possible values are 10^{-5} through 10^{-9}, with a default value of 10^{-6}. Only the BCP3 TSI circuit pack supports the provisionable signal degrade function.

Alarm Level for SA/NSA STS Path AIS Condition:
The alarm level for a service affecting (SA) path AIS condition can be provisioned for both ring and non-ring channels. The alarm level for a non-service affecting (NSA) path AIS condition can only be provisioned for ring releases.

The input parameters are:

Address Address identifies the STS-1 channels.

Valid Ring and Linear Addresses: **all, mb-{1-12,all}**

dgr *SignalDegrade* specifies a bit error rate (BER) threshold for the STS-1 channel in terms of a logarithm to base 10. When this threshold is crossed, an alarm will be raised and automatic protection switching to the STS-1 protection path will be initiated. The only valid address for the SignalDegrade parameter is **all**. To provision the signal degrade function, this command requires that the TSI slot(s) be equipped with BCP3 TSI circuit packs. For OC-12, the signal degrade is an integer with range -5 through -9 and default or original value of -6.

nsa This parameter is available in OC-12 ring releases. This parameter is the provisioned alarm level of the non-service affecting STS-1 path AIS and has the following values:

mn Minor alarm (default)

nr Not alarmed and not reported.

sa This parameter is the provisioned alarm level of the service affecting STS-1 path AIS and has the following values:

- **cr** Critical alarm (default for ring channels)
- **mn** Minor alarm (non-ring channels only, default)
- **na** Not alarmed, but reported
- **nr** Not alarmed and not reported (non-ring channels only)

If the signal degrade parameter is entered and the address used is any value other than "all" the command will be denied with the following message:

```
/* The only valid address for the signal degrade parameter is { all }.
   To set the signal degrade parameter enter
 set-sts1:all:dgr=value; */
```

To provision the AIS parameters requires that either an STS-1 or at least one VT cross-connection exist in the specified address range or the command will not execute, and the following message will be displayed.

```
SNVS
/* Status, Not in Valid State */
/* The specified path is not properly cross-connected. */
```

If the slots are not equipped at all or incorrectly equipped, the command will be denied with the following message:

```
ENEQ
/* Equipage, Not EQuipped */
/* Circuit pack type with signal degrade function is missing. */
```

If an attempt is made to execute this command, when a mix of incompatible OLIU packs exists in Main, the request will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* Both main slots must be equipped with compatible OLIU packs. */
```

In OC-12 ring releases, the following confirmation message will be displayed after command entry:

```
/* Caution!  Alarm or maint. thresholds are affected by this command.
   You have selected the set-sts1 command with this parameter:

   SignalDegrade = <value>
   ServiceAffectingAIS = <value>
   NonServiceAffectingAIS = <value> */

   Execute? (y/n or CANcel/DELete to quit) =
```

NOTE:
If an STS-1 address of **all** is provisioned, this command will skip silently all STS-1 channels that are cross-connected as passthrough, dropped not terminated, or not cross-connected at all.

RELATED COMMANDS

rtrv-sts1

NAME

set-sts3c: Set STS-3c Characteristics

INPUT FORMAT

set-sts3c:*Address*:**dgr=***SignalDegrage*[,**nsa=***Alarm*][,**sa=***Alarm*];

DESCRIPTION

This command provisions the signal degrade alarm threshold of dropped non-terminated STS-3c channels from the high-speed ring channels. The command also provisions the alarm level for an STS-3c path AIS condition on a channel dropped from a high-speed ring. Incoming STS-3c channels on an optical extension are not monitored.

This command is used only for path protected ring applications. The signal degrade parameter provisions all STS-3c cross-connected channels on a per shelf basis. The AIS alarm level parameter provisions the addressed STS-3c cross-connected channels.

The BCP3 TSI circuit pack supports the provisionable signal degrade function.

The input parameters are:

Address Address identifies the STS-3c channels.
Valid Addresses: **all, mb-{l,4,7,10}**

dgr SignalDegrade specifies the bit error rate (BER) threshold for the active STS-3c channel in terms of a logarithm to base 10. When this threshold is crossed, an alarm will be raised and automatic protection switching of the service channel will be initiated. The SignalDegrade is a per shelf parameter and must be set with the form: **set-sts3c:***all*:dgr=*value*;

The signal degrade is an integer with range -5 through -9 and default value of -6. Only dropped signals are monitored.

nsa Alarm is the provisioned alarm level of the non-service affecting STS-3c path AIS and has the following values:

- **mn** Minor alarm (default)
- **nr** not alarmed and not reported

sa Alarm is the provisioned alarm level of the service affecting STS-3c path AIS and has the following values:

- **cr** Critical alarm (default)
- **na** Not alarmed, but reported

If the signal degrade parameter is entered and the address used is any value other than **`all`**, the command will be denied with the following message:

```
/* The only valid address for the signal degrade parameter
   is { all }.  To set the signal degrade parameter enter
   set-sts3c:all:dgr=value; */
```

Before provisioning the STS-3c AIS paramete, the DDM-2000 must have an STS-3c cross-connection and channel state for the specified address. If no cross-connection or channel state exists, or the command will not execute and the following message will be displayed:

```
SNVS
/* Status, Not in Valid State */
/* The specified path is not properly cross-connected. */
```

The command requires that both TSI slots be equipped with BCP3 TSI circuit packs. If the slots are not equipped at all or incorrectly equipped, the command will be denied with the following message:

```
ENEQ
/* Equipage, Not EQuipped */
/* Circuit pack type with signal degrade function is missing. */
```

The following confirmation message will be displayed after command entry:

```
/* Caution!  Alarm or maint. thresholds are affected by this command.
   You have selected the set-sts3c command with this parameter:

   SignalDegrade = <value>
   ServiceAffectingAIS = <value>
   NonServiceAffectingAIS = <value> */

   Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

rtrv-sts3c

NAME

set-sync: Set Synchronization Characteristics

DESCRIPTION

CAUTION:
Execution of this command may affect service.

This command provisions the synchronization mode switching, synchronization source, and output mode of the timing signals when the TGS or the TG3 (BBF4) circuit pack hardware is provisioned to be externally timed, internally timed, or line timed.

Beginning with DDM-2000 OC-12 Release 7.0 and later, this command will also be used with the new Stratum 3 timing circuit pack, TG3 (BBF4). This pack can not be used in combination with either of the two TGS circuit packs (BBF2/BBF2B) in the same network element. The BBF4 circuit pack can be used in any BBF2B application. Care must be taken to ensure that a system equipped with these new BBF4 circuit packs will not receive its sync source for line-timing from another system that is equipped with either BBF2 or BBF2B TGS packs.

Each DDM-2000 can be provisioned to one of these timing modes:

- Free running from an internal oscillator.
- Line-timed from an incoming optical interface. This timing reference is used to generate all outgoing signals. If the optical line is protected, the line selected for transmission is also the line selected as the timing reference.
- External timing from a DS1 reference signal. Each TGS or TG3 circuit pack receives one DS1 reference signal which it monitors and from which it recovers a clock signal. The recovered clock is cross-fed to the companion TGS or TG3 circuit pack on the same shelf. If a DS1 reference failure is detected on one timing circuit pack, the other will take the reference from the companion TGS or TG3 on the same shelf.

These timing modes are supported by both the BBF2 and BBF2B TGS circuit packs, and the BBF4 TG3 circuit packs. The BBF2B circuit pack can be used in any BBF2 application and is preferred for use in ring applications.

Use of this command may affect timing for other network elements of the timing network.

NOTE:
This command is available to privileged users only for all CIT or DCC ports on the shelf.

INPUT FORMAT

The following parameters are available for this command when provisioned for a specific synchronization reference. Parameters may vary depending upon whether the application is linear or rings.

RING SYSTEMS - LINE TIMED

set-sync:[**mdsw=***ModeSwitching*][,**src=***SynchronizationSource*]
[,**auto=***SyncAutoreconfiguration*]; (BBF2 or BBF2B pack type)
set-sync:[**mdsw=***ModeSwitching*][,**src=***SynchronizationSource*]
[**aisthres=***AISThreshold*][,**auto=***SyncAutoreconfiguration*];
(BBF4 for OC-12 R7.0 and later)

When using the BBF2B TGS or BBF4 TG3 circuit pack, the *SynchronizationSource* parameter is used to select the optical line for *shelf* timing.

RING SYSTEMS - EXTERNAL TIMING

set-sync:[**mdsw=***ModeSwitching*]; (BBF2 pack type)

set-sync:[**mdsw=***ModeSwitching*][,**src=***SynchronizationSource*];
(BBF2B pack type)
set-sync:[**mdsw=***ModeSwitching*][,**src=***SynchronizationSource*]
[,**aisthres=***AISThreshold*];
(BBF4 for OC-12 R7.0 and later)

NOTE:
For all applications, if the TGS or TG3 circuit pack is hardware provisioned for DS1 output in SYNC OUT mode, the *SynchronizationSource* parameter is also used to select the optical line for DS1 output.

The input parameters are:

mdsw ModeSwitching may have one of the following values:

revertive Revertive mode switching (default value).
If the system switches to holdover timing mode due to a failure of the timing references, it will automatically switch back to the provisioned timing mode (`External` or `LineTimed`) after one of the references becomes good.

nonrevertive Nonrevertive mode switching.
If the system switches to holdover timing mode due to a failure of the timing references, it will *not* automatically switch back to the provisioned timing mode (`External` or `LineTimed`) after the reference becomes good. The **switch-sync** command must be used to restore the system to the provisioned timing mode (`External` or `LineTimed`).

src SynchronizationSource. This parameter selects the line from which shelf line timing and/or the DS1 synchronization output will be derived. For ring releases, the BBF2 or BBF2B TGS or BBF4 TG3 circuit packs may be used. This parameter may have one of the following values:

main-b-1 For ring releases (default).

main-b-2 For ring releases.

aisthres

AISThreshold. It is applicable to the BBF2B and BBF4 circuit pack types. This parameter sets the incoming synchronization message quality level of the active reference upon receiving of which AIS signal is transmitted on the DS1 output of the BBF2B TGS or BBF4 TG3 circuit packs. As long as the incoming quality level number is at or greater than the provisioned level, AIS will be transmitted. This parameter is listed in ascending quality order and may have one of the following values:

level5 This is the default value. Send DS1 AIS for incoming quality level 5 (K2: Internal Clock, S1: Traceable SONET Clk) or greater (that is, quality level 6 or 7).

level4 Send DS1 AIS for incoming quality level 4 (K2: Stratum 3, S1: Traceable Stratum 3) or greater.

level3 Send DS1 AIS for incoming quality level 3 (K2: Stratum 2, S1: Traceable Stratum 2) or greater.

level2 Send DS1 AIS for incoming quality level 2 (K2: Sync Quality Unknown, S1: Sync Trace Unknown) or greater.

auto SyncAutoreconfiguration allows the system to choose the best timing source to use when it is provisioned for Line Timing. The synchronization source selection is based on the synchronization messages received from the available timing (synchronization) sources. Automatic Protection Switching takes place to the standby timing source when the active source fails. The switch is nonrevertive, and there will not be an automatic switch back to the former timing reference.

When SyncAutoreconfiguration is enabled, the system automatically reconfigures between line timing sources **main-b-1** and **main-b-2**.

NOTE:
When the shelf is equipped with 26-type OLIUs, *auto* is **enabled** by default.

Use the **switch-sync** command to manually switch to the other timing source.

enabled SyncAutoreconfiguration is active.

disabled SyncAutoreconfiguration is not active (default).

If hardware provisioning switches are set for FreeRunning timing mode, execution of this command will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* System provisioned for free-running. */
```

When sync messages are active (as set by the **set-oc3** and/or **set-oc12** commands) and a user requests to set the timing source to a LineTime source which has a sync message that does not support timing, the command will be completed, but the following message will be displayed:

```
/* Source selected currently is unusable for timing.
   Timing will switch to holdover or if Sync Autoreconfiguration is
   enabled, timing may switch to other source. */
```

If this command is entered and both timing slots are empty, the command will be denied with the following message:

```
EQWT
/* EQuipage, Wrong Type */
/* No change in provisioning - both timing slots are unequipped */
```

For SyncAutoreconfiguration, several other parameters must be set before this feature can be enabled. If these parameters are not set, the SyncAutoreconfiguration request will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* <message reason>
Sync Autoreconfiguration cannot be enabled */
```

Valid message reasons include the following:

- K byte messages disabled
- Sync messages disabled.
- Shelf not line timed

If an attempt is made to execute this command when a mix of incompatible OLIU packs exists in the Main slots, the request will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* Both main slots must be equipped with compatible OLIU packs. */
```

When SyncAutoreconfiguration is available, (in ring applications only), the following confirmation message will be displayed after command entry:

```
/* Caution!  Execution of this command may modify network
   synchronization and affect service.
   You have selected the set-sync command with these parameters:

   ModeSwitching = x
   SynchronizationSource = x
   OutputMode = x
   SyncAutoreconfiguration = x */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

rtrv-sync

set-oc3

set-oc12

switch-sync

NAME

set-t3: Set T3 Characteristics

INPUT FORMAT

set-t3:*Address*:[**md=***Mode*][,**ais=***AlarmIndicationSignal*][,**alm=***AlarmLevel*]
[,**fth=***FailureThreshold*][,**pmmd=***PMMode*][,**frame=***Frame*][,**fmt=***Format*];

DESCRIPTION

CAUTION:
Execution of this command may affect service.

This command sets the characteristic parameters of one or more DS3 ports. These characteristics include alarm levels, failure thresholds, AIS conditions, and performance monitoring.

The input parameters are:

Address Address is the address of the DS3 port(s) to be provisioned. One or all ports may be specified.

Valid DS3 Port Addresses: **{a,b,c,d}-{1-3,all},all**

md Mode is the violation monitor removal mode of the DS3 signal. This parameter may have one of the following values:

- **vmr** Monitor and remove DS3 P bit errors (default value).
- **vm** Monitor but do not remove DS3 P bit errors.
- **cc** Clear channel — Do not monitor or remove DS3 P bit errors.

If this parameter is set to **vmr** or **vm**, the **ais** parameter will not be prompted for.

If this parameter is set to **cc**, the **pmmd**, **frame**, and **fmt** parameters will not be used. Also in this case, the **pmmd**, **frame**, and **fmt** parameters will keep their current values. The current values for both parameters will be available to be used whether the value of **md** is set to vm or vmr.

ais AlarmIndicationSignal determines whether or not a DS3 AIS should be inserted. The value may be yes or no. When AIS is set to yes:

— DS3 AIS is inserted towards the DSX-3 upon detection of an OC-3 or OC-12 loss of signal or STS path AIS incoming from the fiber.

— DS3 AIS is inserted towards the fiber upon detection of DS3 LOS incoming from the DSX-3.

NOTE:
AIS is always inserted if the violation monitor removal mode is provisioned for `vmr` or `vm`.

NOTE:
If **md** value was set to `vmr` or `vm`, and it is set to `cc` the AIS always defaults to `off` value.

alm AlarmLevel sets the alarm level for an incoming DS3 Signal Failure and may be one of the following:

cr Critical Alarm

mj Major Alarm

mn Minor Alarm

na No Alarm

The default alarm level is critical. If the system is provisioned for no alarm and there is a loss-of-signal condition, the NE ACTY LED on the user panel will be illuminated, and the fault LED on the circuit pack will flash. The condition will be reported in the alarm

fth FailureThreshold sets the Failure Threshold in terms of a logarithm to the base 10. The value may be either -6 or -3, corresponding to BERs of 10^{-6} and 10^{-3}, respectively. The default value is -3. When the failure threshold is crossed, an alarm will be raised.

pmmd PMMode is only used for performance-monitoring (PM). Setting this parameter does not affect the transmitted or received signal. This parameter will appear only if the **vmr** or **vm** mode has already been selected. This parameter may be one of the following values:

on DS3 PM turned on. This is the default value.

off DS3 PM turned off. PM data is neither collected nor reported in this mode.

frame Frame is only used for performance-monitoring (PM) on the BBG4/BBG4B, BBG11/BBG11B, or BBG19 circuit packs. Setting this parameter does not affect the transmitted or received signal. This parameter will appear only if the **vmr** or **vm** mode has already been selected. This parameter may have one of the following values:

m13 The incoming DS3 signal from both the fiber and the dsx-3 is of the M13 framing type. This is the default value.

cbit The incoming DS3 signal from both the fiber and the dsx-3 is of the C-bit framing type.

fmt Format supports the PMMode and Frame parameters and sets the type of PMON that will appear in the DS3 PM report. This parameter will appear only if the **vmr** or **vm** mode has already been selected. If the **cc** mode is selected, these parameters will not be visible to the user. This parameter may have one of the following values:

pbit When this value is selected, the DS3 PM report will display counts of SEFS as well as DS3 P-bit CV, ES, SES, and UAS (default value). This option is valid for both **frame** types.

fmbit When this value is selected, the DS3 PM report will provide counts of SEFS as well as DS3 adjusted F&M bit CV, ES, SES, and UAS. This option is valid for both **frame** types.

cpbit When this value is selected, the DS3 PM report will provide counts of SEFS as well as DS3 CP-bit parity CV, ES, SES, and UAS for both near-end and far-end (FEBE) data. This option is valid ONLY for **cbit** type of **frame**.

The following confirmation message will be displayed after command entry:

```
/* Caution! Execution of this command may affect service.
You have selected the set-t3 command with these parameters:

   Address = x
   Mode = x
   AlarmIndicationSignal = x
   AlarmLevel = x
   FailureThreshold = x
   PMMode = x
   Format = x */

Execute? (y/n or CANcel/DELete to quit) =
```

NOTE:
The above display will only prompt for the alarm indication signal (AIS) if the Mode is set to cc. The above display will only prompt for the PMMode and Format if the Mode parameter is set to vmr or vm.

If the **m13** frame and **cpbit** format options have both been selected, the following denial message will be displayed:

```
/* <address> - invalid combination of frame and format --
provisioning unchanged */
```

The following confirmation message will be displayed after the command entry when addressing a group of packs using all in the address:

```
/* Caution! Execution of this command may affect service.
You have selected the set-t3 command with these parameters:

   Address = x
   Mode = x
   AlarmIndicationSignal = x
   AlarmLevel = x
   AISAlarmLevel = x
   FailureThreshold = x
   PMMode = x
   Frame = x
   Format = x
   Xbit = x */

Execute? (y/n or CANcel/DELete to quit) =
```

If multiple addresses are specified, the following caution message will be printed out immediately before the confirmation request message:

```
/* Caution: This command addresses multiple objects within this
system.  Selections other than CurrentValues will affect all
addressed objects. */
```

RELATED COMMANDS

rtrv-t3

set-state-t3

NAME

set-trace-sts1: Set STS Path Trace Characteristics

INPUT FORMAT

set-trace-sts1:*Address*[:**EXPTRC=Expectedincomingpathtrace]**
[,TRC=OutgoingPathTrace];

DESCRIPTION

This command assigns user-selectable alphanumeric character strings to the transmit and receive path trace fields of an STS cross-connected STS-1 signal. The allowed ASCII characters include the letters "A" through "Z" and "a" through "z", numbers "0" through "9", and the following special characters:

# (pound sign)	$ (dollar sign)
% (percent sign)	& (ampersand)
((open parenthesis)	) (close parenthesis)
+ (plus)	* (asterisk)
| (pipe)	- (hyphen)
[(open square bracket)	] (close square bracket)
{ (open bracket)	} (close bracket)
’ (apostrophe)	‘ (grave accent)
. (period)	/ (slash)
< (less than)	> (greater than).

NOTE:
This feature is only applicable to STS paths terminating to a BBG11B circuit pack.

The input parameters are:

Address This is a STS-1 channel address of the SONET path terminating signal for which the path trace is assigned.

Valid Addresses (within OC-12): **mb-{1-12}** For Release R7.0,
Valid Addresses (within OC-3): **{a,b,c,d}-{1-3}**

EXPTRC EXPTRC specifies the expected incoming path trace message. It is a string of 62 or less alphanumeric characters.

TRC TRC specifies the outgoing path trace message. It is a string of 62 or less alphanumeric characters.

If the channel is not cross-connected to a STS-1 PTE, the request will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* Valid cross-connection does not exist. STS Path trace cannot be set. */
```

If the STS-1 channel for which this command was issued is not available, the request will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* Address points to a non-existent channel. */
```

If an attempt is made to set the path trace for an STS path other than the one terminated to a 3DS3 (BBG11B) circuit pack, the request will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* Check the eqquipage. BBG4B for OC-3 and BBG11B for
   OC-12 is required. */
```

If an attempt is made to execute this command, when a mix of incompatible OLIU packs exists in Main, the request will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* Both main slots must be equipped with compatible OLIU packs. */
```

When input, this command will cause the following confirmation request to be displayed:

```
/* You have selected the set-pthtrc command with these
   parameters:

   Address = address
   EXPTRC = message
   TRC = message

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

rtrv-trace-sts1

rtrv-crs-sts1

set-sts1

NAME

set-x25: Set X.25 Link

INPUT FORMAT

`set-x25:PKT=`*`pkt`***`;`**

DESCRIPTION

This command sets the packet size of the X.25 link. The packet size may be set to either 128 or 256.

CAUTION:
Execution of this command may affect TL1 communication and will reset the GNE X.25 link. Also, this command will cause all active TL1 logins to be automatically dropped. In addition, all established SVCs on the affected X.25 link will need to be reestablished.

This command should be used at installation time, when network activities are at their minimum level or when the X.25 link can be disabled.

NOTE 1:
This command is available to privileged users only, if security is enabled.

NOTE 2:
While this command may be executed at all network elements in the subnetwork, it will only be active at the GNE.

The input parameter is:

`pkt` This parameter sets the packet size. The valid values are `128` or `256` (default value).

When this command is entered, the following confirmation message will be displayed:

```
/* Caution! If this shelf is an active GNE, X.25 link/TL1
communication is affected by this command.  When executed,
this command causes the GNE x.25 link to be reset, all active
TL1 logins to be dropped, and all SVCs to be cleared.

You have selected the set-x25 command with this parameter:

    PKT = 128/256  */


Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

rtrv-x25

NAME

switch-fn: Protection Switch Function Unit

INPUT FORMAT

switch-fn:*Address*:**pri=***Priority*;

DESCRIPTION

CAUTION:
Execution of this command may affect service.

This command controls operation of function unit circuit pack protection switching when equipped with termination packs such as 3STS1E, or 3DS3 circuit packs.

The input parameters for this command are:

Address Address of the function unit slot pair.

Valid Addresses: **fn-{a,b,c,d}**

pri Priority indicates the priority of the protection switching request and has the following values:

reset	Clear active external switch requests.
inhibit	Prevent further switches (automatic, manual, or forced) until the switch is reset.
forced	Switch to the standby slot, whether it is good or not, and prevent further switches (automatic or manual) until the switch is reset.
manual	Switch to the standby slot only if it is good.

After entering this command, the following confirmation message is displayed:

```
/* Caution! Execution of this command may affect service.
   You have selected the switch-fn command with these parameters:

   Address = x
   Priority = pri */

Execute? (y/n or CANcel/DELete to quit) =
```

If this command is executed with priority **`inhibit`** or **`forced`**, then automatic protection switching will be disabled until this command is executed again with priority **`reset`**.

RELATED COMMANDS

rtrv-state

switch-line

NAME

switch-path-sts1: Switch Path STS-1

INPUT FORMAT

switch-path-sts1:*Address*:**pri=***Priority*;

DESCRIPTION

This command controls STS-1 path switching on path protected ring configurations. Path switching is always unidirectional (one-way).

The input parameters are:

Address — Address is the address of the STS-1 channel currently carrying dropped or drop and continue traffic. When this command is executed, traffic will be switched away from this path to the other path on the ring. There is no default for this parameter. Traffic that drops to a function unit provisioned for the 0x1 ring or video application cannot be switched.
Valid OC-12 Addresses: **mb{1,2}-{1-12,all}**

pri — Priority indicates the priority of the protection switch request. The one and only valid value is *manual*. This requests a switch from the addressed path to the standby path unless a path signal fail or path signal degrade exists on the standby path.

NOTE:
A drop and continue path is simultaneously dropped to a low-speed interface and passed through.

If the path address specified in the command is not equipped or the STS-1 channel is not drop, add/drop, or drop and continue cross-connected, the command will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* The specified path is not equipped and/or cross-connected. */
```

If the addressed path is associated with a connection of type

- pass-through
- 0x1 ring
- 0x1 DS3
- dual locked

the command will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* The specified path cannot be switched. */
```

NOTE:
A pass-through path passes directly from the OC-N receiver to the OC-N transmitter. The service carried with this path is not dropped at this node.

If an equal or higher priority switch already exists on the addressed path, the command will be denied with the following message:

```
SPSP
/* Status, Protection Switch Priority */
/* Equal or higher priority switch exists */
```

If **-all** appears in the address and if an equal or higher priority switch already exists on some of the addressed paths or the path is part of an STS-3c cross-connected channel, the command will already exists on some of the addressed paths, the command will list these exceptions as follows:

```
/* sts1 address equal or higher priority switch exists
   sts1 address vt cross-connected signals exist
       .
       .
*/
```

If **-all** appears in the address and the path is not equipped, not cross-connected, or is a pass-through or 0x1 ring connection, the path will be silently skipped.

Since DDM-2000 path switching is unidirectional, the user will receive the following notification message immediately before the confirmation request:

```
/* The path protection switching request is unidirectional.
   It may be necessary to perform a switch-path-sts1 at the far end
   to switch both transmit and receive to the same path. */
```

After entering this command, the following confirmation message is displayed:

```
/* Caution! Execution of this command may affect service.
   You have selected the sw-path-sts1 command with these parameters:

   Address=
   Priority=        */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

rtrv-crs-sts1

rtrv-crs-vt1

rtrv-state-eqpt

rtrv-state-path

NAME

switch-path-sts3c: Switch Path STS3c

INPUT FORMAT

switch-path-sts3c:*Address*:**pri=***Priority*;

DESCRIPTION

This command controls STS-3c path switching on path protected ring configurations. Path switching is always unidirectional (one-way).

This command is available with OC-12 Release 5.0 and later ring releases.

The input parameters are:

Address Address is the address of the STS-3c channel currently carrying dropped or drop and continue traffic. When this command is executed, traffic will be switched away from this path to the other path on the ring. There is no default for this parameter. Traffic that drops to a function unit provisioned for the 0X1 ring or video application cannot be switched. Valid addresses are: **mb{1,2}-{1,4,7,10,all}.**

pri Priority indicates the priority of the protection switch request. The one and only valid value is *manual*. This requests a switch from the addressed path to the standby path unless a higher priority condition exists on the standby path.

If the path address specified in the command is not equipped or the STS-3c channel is not dropped, or drop and continue cross-connected, the command will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* The specified path is not equipped and/or cross-connected. */
```

If the path address specified in the command is a dropped path to a 0X1 application in the function unit, the command will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* The specified path cannot be switched. */
```

If the path address specified in the command is an STS-1 cross-connected channel, the command will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* The specified path is not properly cross-connected. */
```

If the path address specified in the command is a pass-through path, the command will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* The specified path does not drop on this system. */
```

If an equal or higher priority switch already exists on the addressed path, the command will be denied with the following message:

```
SPSP
/* Status, Protection Switch Priority */
/* Equal or higher priority switch exists */
```

If **-all** appears in the address and if an equal or higher priority switch already exists on some of the addressed paths, or some paths are STS-1 cross-connected channels, the command will list these exceptions.

```
/* sts3c address equal or higher priority switch exists
   sts3c address not properly cross-connected
       .
*/
```

If **-all** appears in the address and the path is not equipped, not cross-connected, or is a pass-through or 0X1 connection, the path will be silently skipped.

Since DDM-2000 path switching is unidirectional, the user will receive the following notification message immediately before the confirmation request:

```
/* The path protection switching request is unidirectional.
   It may be necessary to perform a switch-path-sts3c at the far
   end to switch both transmit and receive to the same path. */
```

After entering this command the following confirmation message is displayed:

```
/* Caution!  Execution of this command may affect service.
   You have selected the sw-path-sts3c command with these
   parameters:

   Address=address
   Priority=value  */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

rtrv-crs-sts3c

rtrv-state-eqpt

rtrv-state-path

NAME

switch-sync: Protection Switch Synchronization

INPUT FORMAT

switch-sync:**s=***SyncFunction*,**pri=***Priority*;

DESCRIPTION

CAUTION:
Execution of this command may affect service.

This command controls operation of the synchronization protection switching. This command lets the user control which synchronization reference is used and enables the user to switch a synchronization reference when needed.

The input parameters are:

s SyncFunction specifies the synchronization function and may be one of the following:

reference	Selects protection switching of DS1 timing references. Specify only if the system is provisioned for `External` DS1 timing.
mode	Selects protection switching of timing mode. Specify only if the system is provisioned for `External` DS1 or `LineTimed`.
circuitpack	Selects protection switching of timing circuit packs.
src	Selects the optical line from which shelf line-timing and/or the DS1 synchronization output will be derived. This parameter is available with OC-12 ring releases. This parameter is only applicable if SyncAutoreconfiguration is enabled using the **set-sync** command. The SynchronizationSources that can be switched are **main-b-1** and **main-b-2**.

pri Priority indicates the priority of the protection switching request. For SyncFunction values of **reference** and **circuitpack**, priority values are:

reset	Clear active protection switch requests
inhibit	Freeze the protection switching mechanism
manual	Switch from active timing reference/circuit pack to standby timing reference/circuit pack

For a SyncFunction value of **mode**, the priority (**pri**) values are:

reset	Clear any active manual switch. This will allow the system to switch back to External or LineTimed if the system is provisioned for non-revertive mode switching or if it has been manually switched to holdover mode.
manual	Switch from the provisioned timing mode, External or LineTimed, to holdover mode. The system will remain in holdover mode until the switch is reset.

For a SyncFunction value of **src**, the priority (**pri**) value is:

manual	Switch from the active SynchronizationSource to the standby source.

If no synchronization source switch can be completed due to the equippage of the alternate sources, the command will be denied with the following message:

```
EQWT
/* EQuipage, Wrong Type */
/* Alternate sync sources improperly equipped */
```

If this command is executed with Priority=**inhibit** or with SyncFunction=**mode**, then automatic protection switching will be disabled until this command is executed again with the same SyncFunction and with Priority=**reset**.

If an equal or higher priority switch (for example, **pri**=inhibit) already exists on the addressed path, the command will be denied with the following message:

```
SPSP
/* Status, Protection Switch Priority */
/* Equal or higher priority switch exists */
```

If the SyncFunction is **src** and the priority of **reset** or **inhibit** is entered, the request will be denied with one of the following denial messages:

```
IDNC
/* Input, Data Not Consistent */
/* Reset not allowed for source switching. */
```

or

```
IDNC
/* Input, Data Not Consistent */
/* Inhibit not allowed for source switching. */
```

If the switch request is issued for the SyncFunction value of **src** and SyncAutoreconfiguration is not enabled, the command will be denied with the following message:

```
SNVS
/* Status, Not in Valid State */
/* SyncAutoreconfiguration is not enabled. */
```

The reference switching (reset, inhibit, manual) applies only to DS1 references. The command will not be executed if **reference** is entered for the synchronization function and the provisioned synchronization mode is not `External`.

If this command is entered and both timing slots are empty, the command will be denied and the following denial message will be displayed:

```
ENEQ
/* Equipage, Not EQuipped */
```

After entering this command, the following confirmation message is displayed:

```
/* Caution!  Execution of this command may affect service.
   You have selected the switch-sync command with these parameters:

   SyncFunction=s
   Priority=pri */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

rtrv-state-eqpt

rtrv-sync

set-sync

NAME

test-alm: Test Office Alarms

INPUT FORMAT

`test-alm`:[**`md=`***Mode*][,**`r=`***Repeat*];

DESCRIPTION

This command tests the audible and visible office alarms and associated user panel LEDs.

The specific office alarm test turns on a specific alarm for 10 seconds and turns it off for 10 seconds, after which the office alarm reverts to its normal operation.

The general office alarm test cycles through the various alarm levels (CR, MJ, MN) at 4-second intervals as shown in the following table:

General Alarm Test

Step	Time (Seconds)	ALARM LEVEL CR	MJ	MN
1	0-4	*off*	*off*	*off*
2	4-8	ON	*off*	*off*
3	8-12	off	ON	*off*
4	12-16	*off*	*off*	ON
5	16-20	*off*	*off*	*off*

The alarm cutoff (ACO) button functions normally while this test is executing. Depressing ACO silences audible office alarms.

Input parameters are:

`md` Mode identifies the office alarm test to be performed. It takes the following values:

- **`all`** General test of all office alarms (default)
- **`cr`** Specific test of critical alarm
- **`mj`** Specific test of major alarm
- **`mn`** Specific test of minor alarm.

`r` Repeat specifies the number of times that Steps 2 through 4 should be repeated. It is an integer with a range of **`1`** through **`10`** and a default value of **`1`**.

This command can be aborted by pressing the "CANcel" or "DELete" key while the command is in progress.

The following denial message will be output if the test cannot be performed due to other activity in the system:

```
test-alm: DENY
SSRB
/* Status, System Resource Busy */
```

NAME

test-led: Test LED Indicators

INPUT FORMAT

test-led:[*Address*]:[**r=***Repeat*];

DESCRIPTION

This command activates circuit pack or user panel LEDs for 10 seconds on, then 10 seconds off, after which the LED reverts to normal operation. This command does not affect office alarms.

This test can also be done by pressing the alarm cutoff (ACO) button on the user panel.

The input parameters are:

Address This is the address of any slot(s) or **userpanel**, with a default value of **all**.

Valid Addresses: **all, main-b-{1,2,all}, fn-{a,b,c,d,all}-{1,2,all}, tg-{1,2,all}, sysctl, auxctl, userpanel**

r Repeat specifies the number of times that the test should be repeated. It is an integer with the range **1** through **10** and a default value of **1**.

This command can be aborted by pressing the "CANcel" or "DELete" key while the command is in progress.

When this command is entered while an alarm test is in progress, the following denial message will be output if the test cannot be done due to other activity in the system.

```
test-led:address DENY
SSRB
/* Status, System Resources Busy */
```

NAME

test-sysctl: Test System Controllers

INPUT FORMAT

`test-sysctl;`

DESCRIPTION

This command causes the entire control system (system controller and overhead controller) to perform a self-test. If this command is entered while a transmission test (**`test-trmsn-t3`**) is in progress, the following denial message will be displayed:

```
SSRB
/* Status, System Resources Busy  */
```

At the end of the test, one of the following messages will be displayed.

If the test passes, the following message will be displayed:

```
test-sysctl: COMPLD
/* Controller Diagnostic Test Report
=================================================================
Test PASSED
*/
```

If the test fails, one of the following messages may be displayed, indicating that one or both controller circuit packs have failed:

```
test-sysctl: COMPLD
/* Controller Diagnostic Test Report
================================================================
SYSCTL CP FAILED
*/
```

```
test-sysctl: COMPLD
/* Controller Diagnostic Test Report
================================================================
OHCTL CP FAILED
*/
```

```
test-sysctl: COMPLD
/* Controller Diagnostic Test Report
================================================================
SYSCTL CP FAILED
OHCTL CP FAILED
*/
```

In addition to a failure message, the Fault LED on the failed circuit pack(s) and the Major alarm LED on the user panel will be illuminated, and the MJ office alarm will be activated.

NAME

test-trmsn-t3: Test Transmission T3

INPUT FORMAT

test-trmsn-t3:*Address*:**[dirn=***Direction*`]`**[,dur=***Duration*`]`**;**

DESCRIPTION

CAUTION:
Execution of this command will affect service. This command causes the insertion of a test signal on the selected channel in the MUX or DEMUX direction and will affect service on the selected channel.

This command sets up an automated transmission test for a low-speed DS3 port. The direction of the test can be towards either the MUX (towards the optical fiber) or the DEMUX (towards the DSX) transmission directions. The test signal is a framed DS-3 signal which DDM-2000 checks for P-bit parity errors. Only one channel is tested each time; multiple channels may not be tested simultaneously. Before this command is executed, the signal must be appropriately looped back.

This command is used for installation of new equipment and for maintenance. In either case, the signal must be appropriately looped back.

If the test is run in the MUX direction and an external loopback is established at the far end, then the far end must be provisioned for clear channel (CC) mode with no AIS in order to test the entire transmission path. If an external loopback is used and the far end is provisioned for VMR Mode, only errors in the receive direction will be monitored.

If the test is run using a DS3 internal loopback, DDM-2000 automatically puts the path in clear channel mode while the loopback is active. When the loopback is released, the mode returns to its previous state.

DDM-2000 checks for the presence of a loopback before beginning the test. If no looback exists, the system will return a warning message before peforming the test.

NOTE:
Loopbacks on the fiber when testing in the MUX direction will cause an "inconsistent DCC switches" alarm condition. The alarm should be ignored during the loopback testing. To avoid this alarm, the user may disable the DCC prior to performing this test.

The input parameters are:

Address Address of the DS3 port.
Valid DS3 Port Addresses: **{a,b,c,d}-{1-3}**

dirn Direction of the transmission test. This parameter has the following values:

mux The test signal is inserted in the MUX direction and the received signal is monitored from the MUX direction (default) as shown in Figure 11-3.

demux The test signal is inserted in the DEMUX direction and the received signal is monitored from the DEMUX direction as shown in Figure 11-4.

dur Duration of the test in minutes. This value has a range of 1 through 120 with a default value of 1.

This command can be aborted by pressing the "CANcel" or "DELete" key while the command is in progress.

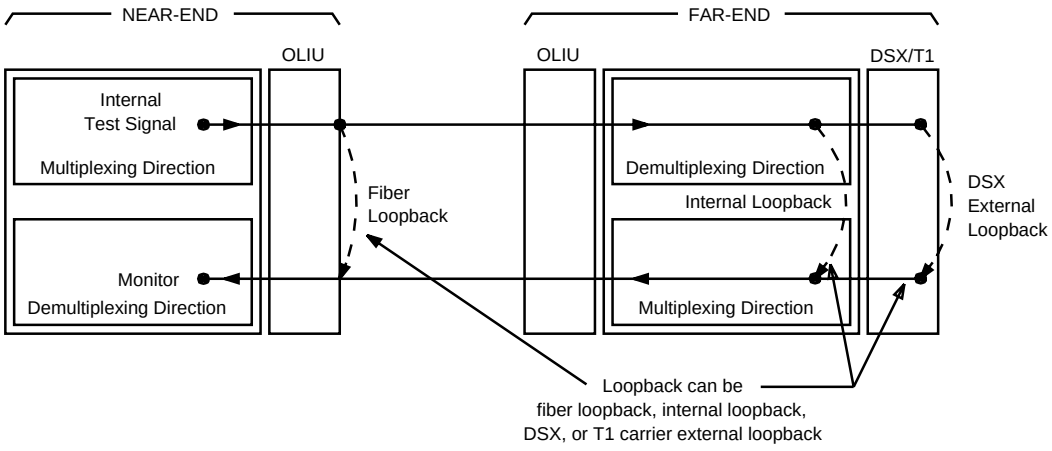


Figure 11-3. Automated Transmission Test of DS3 Signal in MUX Direction

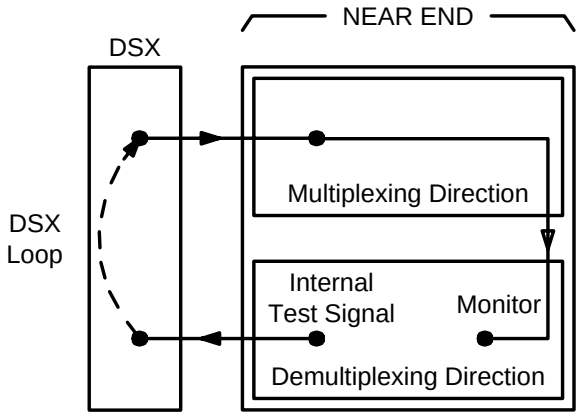


Figure 11-4. Automated Transmission Test of DS3 Signal in DEMUX Direction

This command displays the following output report:

```
/* DS3 Transmission Test Report
============================================================
DS3 Port = addr, Direction = dirn, Duration = dur minutes
============================================================
Elapsed       Errored
Time(sec)     Seconds
============================================================
 n              n      Out Of Frame
 .              .
 .              .
 .              .
  */
```

The output parameters are:

`DS3 Port`	The address of the DS3 port
`Direction`	The direction of the transmission test
`Duration`	The duration of the test in minutes
`Elapsed Time`	Elapsed time of the test in seconds
`Errored Seconds`	Total number of errored seconds.

A question mark (`?`) as the rightmost character in the `Errored Seconds` column indicates uncertain data because of a protection switch during the test.

The message "Out Of Frame" appears in the report if an out-of-frame condition is detected during the test.

If an equipment failure is detected during the test, the following message is displayed:

```
/* Hardware Failed - Test Aborted */
```

The system checks for the presence of a loopback at the beginning of the test. If a loopback does not exist, the test continues and the following message appears before and after the report:

```
/* Preliminary hardware test indicates no loopback. */
```

If the test is interrupted or aborted, the following message is displayed:

```
/* Test Manually Aborted */
```

The following denial message will be output if the test cannot be performed due to other activity in the system:

```
SSRB
/* Status, System Resources Busy */
```

When this command is entered, the following confirmation message is displayed:

```
/* Establish appropriate loopbacks (manual or electronic)
   prior to test execution, if appropriate. */

/* Caution! Execution of this test may interrupt service.
   You have selected the test-trmsn-t3 command with these parameters:

   Address = x
   Direction = dirn
   Duration = dur */
Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

opr-lpbk-t3

rls-lpbk-t3

rtrv-pm-t3

NAME

toggle: Toggle Between Local and Remote Sessions

INPUT FORMAT

^t (Press "**t**" while holding the CTRL key)

DESCRIPTION

This command toggles the user between the local and remote sessions. It provides a quick and easy way to switch from the local session to the remote session, while not terminating either one. The user must have established two valid sessions with network elements (NEs) in the local NE's subnetwork before this command executes successfully.

This command may be entered *only* between command executions; that is, *only* at the system prompt. If entered as a response to a parameter prompt, an error message will be displayed.

This command does not display a typical completion message. When entered, the TID for the NE switched to is displayed, followed by the date and time. This line is followed by a prompt from that system.

The following denial message will be output if the toggle cannot be performed.

```
SNVS
/* Status, Not in Valid State */
/* No remote login is active */
```

If the toggle request fails due to a far-end communication failure (after trying for 45 seconds or more), the following denial message will be displayed:

```
SROF
/* Status, Requested Operation Failed */
/* Far end Communication failure */
```

RELATED COMMANDS

logout

rlgn

NAME

upd: Update Equipment List

INPUT FORMAT

upd;

DESCRIPTION

CAUTION:
Execution of this command may affect service.

This command updates the system data base (as recorded in the nonvolatile memory) to reflect the existing hardware configuration and incoming signals.

This command can be executed either by pushing the Update/Initialize button, located on the SYSCTL circuit pack or by entering the command from the CIT. When the Update/Initialize button is pushed, a dot (.) will appear on the 7-segment display.

NOTE 1:
An**upd** may be performed at any time *except* before or during the 10-second window after powering up the System Controller (SYSCTL) while the critical (CR) LED is flashing.

NOTE 2:
The user should note that the critical LED light on the SYSCTL circuit pack will continue to flash after pressing the Update/Initialize button for a system reset. Do *not* reenter this command. The LED light will stop flashing after 10 seconds.

This command should be executed after the following:

- Removing a circuit pack — Activating the **upd** command following circuit pack removal deletes the circuit pack from the equipment list and clears the associated alarm. This command also changes the slot state to *auto*. Failure to update after removing a circuit pack will continue the "CP removed" alarm, which will become an "unexpected CP type", or similar alarm when a new and different type of circuit pack is placed in the slot. Performing the update at this later time will clear this alarm and provide default provisioning for the new circuit pack, provided the circuit pack is acceptable.
- Removing a signal input — When an incoming DS1 or EC-1 signal is removed, the system data base must be updated to reflect the change and clear the associated alarm.

- Removing an STS1 or VT1.5 AIS alarm for incoming channels.
- Changing a switch setting on a circuit pack — The **upd** command should be activated following switch setting changes on the 21G OLIU, or BBF2/BBF2B TGS circuit packs. This command enters the new settings into the system. Failure to update will cause an "unexpected CP switches" or "unexpected CP type" alarm, since the new switch settings do not agree with the switch settings already recorded in the system. Activating the update function will clear this alarm and make the new switch settings effective.

- Replacing Circuit Pack types — The user can "upgrade" from one type of circuit pack to another type in the following cases.

  Automatic Upgrades — no alarms occur and there is no need to update:

  1. For timing slots — from BBF2 to BBF2B type TGS packs.
  2. For low-speed slots — from any BBG11/BBG11B to any other BBG11B/BBG11 type 3DS3 pack
  3. For 1+1 slot pairs — from any 23 to any other 23-type OLIU packs

  Manual Upgrades — "unexpected CP type" alarm will occur, and an update must be done:

  1. For low-speed slots — from BBG12 3STS1E to 21-type OLIU packs for ring applications.
  2. For low-speed slots — from BBG11/BBG11B 3DS3 to 21-type OLIU packs for ring applications.

  Manual Upgrades — "unexpected CP switches" alarm will occur and an update must be done:

  1. For timing slots — between BBF2B and BBF2 TGS packs.

  Following the documented upgrade procedures (slot 1 of 1x1 or 1+1 pairs), the old type circuit pack is removed and replaced with the new type circuit pack. Activating the update function will clear the alarm for new pack type and make the new circuit pack settings active.

  Note: Upgrading from a 1x1 3STS1E or 3DS3 to an OC-3/IS-3 will force the application to 1+1.

ALARM RESTRICTIONS

Pressing the UPD button or issuing the **update** command will *not* change provisioning if the following alarms exist. The user will have to correct the alarmed condition before executing this command. These alarms are:

- illegal CP type
- CP not allowed -(*reason*)
- invalid CP switches.

SYSTEM RESTRICTIONS AND CORRECTIVE ACTIONS

Pressing the UPD button or issuing the **update** command will not retire a "CP removed", "unexpected CP type", or "unexpected CP switches" alarm or allow the system to accept the new provisioning request if certain system conditions exist. The user will have to correct the condition before updating the system.

If a restriction is detected, the following message will be displayed:

```
/* Address not equipped properly -- provisioning unchanged. */
```

The system restriction and corrective actions needed are:

- **Port status in NMON or IN SERVICE**
  If a low-speed circuit pack is removed before the incoming signal is removed or while the associated port or ports are in the *nmon* state, the system will not recognize that the service is no longer being carried on the port and will not remove the circuit pack from the equipment list. Note that this restriction does not apply to OLIU circuit packs in systems that support OC-N line states.
  Corrective Action: If the port is in the *nmon* state, it must be moved to the *auto* state, using the **set-state-t3** or **set-state-ec1** command, before the circuit pack can be removed and the system can be updated. If an incoming signal is present, it must first be removed, then the circuit pack can be removed, and the system can be updated.

- **Manual cross-connection exists**
  A manual cross-connection is entered into the system when an arrangement other than the default is desired and to support various applications.
  Corrective Action: The system will not recognize a circuit pack removal until the manual cross-connection to the addressed circuit pack is deleted. (See the **dlt-crs-sts1** and **rtrv-crs-sts1** commands for more information on manual cross-connections.)

For 1+1, 1x1 and 0x1 slot pairs, one circuit pack of the pair can be removed as long as the other remains to support the cross-connection. For rings systems, the MAIN-B and TSI circuit packs are special and all cross-connections in the system must be deleted before the addressed circuit pack can be removed.

- **Upgrades from Slot 2**
  Upgrades from Slot 2 of a 1x1 or 1+1 pair are not permitted when Slot 1 is equipped.
  Corrective Action: The documented upgrade procedures to change one type of circuit pack for another require that the change first be made in slot 1 of a slot pair when slot 1 is equipped.

- **Timing Source removed**
  When the sync timing source is provisioned to be LineTimed and the addressed circuit pack is selected for timing, the slot state will not change to *auto*.
  Corrective Action: Insert an OLIU circuit pack that supports the timing selected or change the timing source.

- **Sync Autoreconfiguration Selected**
  When the sync timing is provisioned for Autoreconfiguration and the addressed circuit pack is one of the sources for timing, the slot state will not change to *auto*.
  Corrective Action: Insert an OLIU circuit pack that supports the timing selected or change the timing provisioning.

- **Change Time setting from Line to External**
  If a system's sync timing source switch from Line to External timing is attempted by changing the switches on the TGS pack to an External timing setting while leaving the sync timing in Autoreconfiguration mode *enabled*, the attempt to switch from Line to External Timing will fail.
  Corrective Action: In order to switch from Line to External timing, the user MUST ensure that in addition to setting the switches on the TGS pack to External timing, the Sync Autoreconfiguration parameter is set to *disabled*.

If a protection switch request of **forced**, **inhibit**, or **lockout** is specified to a slot that is now empty, entering the **upd** command may cause the protection switch to occur possibly affecting service. When this occurs, the following confirmation message will be displayed:

```
/* Caution!  Execution of the update command may interrupt
   service because of an active protection switch request on
   an empty slot.  It also updates the equipment list and
   initializes ALL parameters associated with empty slots. */

Execute? (y/n or CANcel/DELete to quit) =
```

RELATED COMMANDS

dlt-crs-sts1

rtrv-crs-sts1

rtrv-crs-vt1

rtrv-state-eqpt

rtrv-state-path

Detailed Alarm and History Reports

This section provides details of the Retrieve Alarm and Retrieve History commands with explanations of specific output messages.

Each command includes an **INPUT FORMAT** part, providing the syntax for the command, and a **DESCRIPTION** part, providing the details of the command input and output parameters. Following the **DESCRIPTION** part is a table listing the output messages associated with each command and a description of each message.

NAME

rtrv-alm: Retrieve Alarm and Status

INPUT FORMAT

rtrv-alm[:alm=*AlarmLevel*];

DESCRIPTION

This command displays a report of active alarm and status conditions of the local network element. The report includes the source address of the alarm, as well as the date and time of the alarm, whether or not the condition is service affecting, and a short description of the condition.

The input parameter is:

alm AlarmLevel for which a report is desired. This parameter may have one of the following values:

all

cr

mj

mn

pmn

other

Alarms are listed from greatest to least severity. Within a severity level, newer alarms are listed first.

Example Alarm Report:

```
/* Active Alarms and Status Report
============================================================
 Alarm       Source    Date   Time      Srv   Description
 Level       Address     Detected
============================================================
 Condition   address   MM-DD HH:MM:SS   srv   description
                             .
                             .
                             .
 Condition   address   MM-DD HH:MM:SS   srv   description
*/
```

The output parameters are:

`Alarm Level` Alarm level is the alarm or status condition being reported. A status condition is named status if there is no user panel LED illuminated for that condition. An alarm condition is the name of the topmost LED on the user panel that is illuminated and may be one of the following conditions:

`CRITICAL`

`MAJOR`

`MINOR`

`PWR MINOR`

`abnormal (status LED)`

`ne-acty (status LED)`

`status (no LED)`

`Source Address` Source address is the address of the event. An event source may be a slot, channel, port, IAO LAN interface or an operations interface. See Table 11-1 at the beginning of this chapter for the address of slots, ports, channels, IAO LAN, and operations interfaces, respectively.

`Date Detected`	Month (MM) and day (DD) of the event.
`Time Detected`	Time (Hours, Minute, Seconds) of event occurrence.
`Srv`	Srv indicates whether the condition is service affecting or not, and may have the following values: SA — Service affecting NSA — Not service affecting - — Not applicable for this condition (not service affecting).
`Description`	Table 11-3 lists the meanings and likely causes of the conditions reported in the alarm and status report. For conditions with more than one possible cause, the most likely causes are listed first.

RELATED COMMANDS

rtrv-hsty

Table 11-3. RTRV-ALM Descriptions

Description	Meaning
`2nd CP reqd for ls eqpt`	The BBF6 (T1EXT) circuit pack requires both function unit slots in the group to be equipped. A second circuit pack of the same type should be inserted in the empty function unit slot.
`–48V power/fuse failed`	A –48 volt power feeder or a fuse on the user panel has failed.
`–48V power/fuse FA|FB failed`	A –48 volt power feeder or a fuse on the user panel has failed. (FA or FB identifies failure if BBG8 controller used.)
`3DS3 CP failed`	Internal equipment failure of the specified 3DS3 CP.
`3STS1E CP failed`	Internal equipment failure of the specified 3STS1E CP.
`AC power failed`	The AC power supply to a remote terminal cabinet has failed.
`ACO active`	The parallel telemetry outputs and audible office alarms normally active due to the alarm conditions in the system are being suppressed. See the **`opr-aco`** command.
`APS channel failed`	The SONET automatic protection switching (APS) channel on the protection OC-3 or OC-12 line has failed. Likely causes: Failure of the OLIU CP on the protection line at the far end; failure of the OLIU CP on the protection line at the near end.
`auto turnup test IP`	An automatic turnup test is in progress.
`control`**`n`**	The specified environmental control point (miscellaneous discrete output) is active. Note: The actual message that appears in the alarm and status report for this condition can be provisioned; this is the default message. See the **`rtrv-attr-cont`** and **`set-attr-cont`** commands. Cause: The system was instructed to close the environmental control point by either a TBOS control point or by the closing of the corresponding environmental control input at the far end.

Table 11-3. RTRV-ALM Descriptions (Contd)

Description	Meaning
`CP removed`	A CP previously installed in this system is removed. The CP should be replaced, or an "update" should be done to remove it from the system equipment list.
`DS3 loopback (to Fiber)`	A loopback (toward the optical fiber) is active on the specified T3 port. See the **`opr-lpbk-t3`** and **`rls-lpbk-t3`** commands.
`DS3 loopback (to DSX)`	A loopback (toward the DSX) is active on the specified T3 port. See the **`opr-lpbk-t3`** and **`rls-lpbk-t3`** commands.
`DS3 trmsn test IP`	A transmission test using the internal test signal generator and monitor is in progress on the specified T3 port. See the **`test-trmsn-t3`** command.
`dormant/exec code mismatch`	This alarm condition is raised when the network element detects that it contains dormant software with a release number that does not match the release number of the executing software.
`EC1 loopback (to Fiber)`	A loopback (toward the optical fiber) is active on the specified EC1 port. See the **`opr-lpbk-ec1`** and **`rls-lpbk-ec1`** commands for more information.
`EC1 loopback (to DSX)`	A loopback (toward the DSX) is active on the specified EC1 port. See the **`opr-lpbk-ec1`** and **`rls-lpbk-ec1`** commands for more information.
`environment`**`n`**	The specified environmental alarm point (miscellaneous discrete input) is active. The actual message that appears in the alarm and status report for this condition can be provisioned; this is the default message. See the **`rtrv-attr-env`** and **`set-attr-env`** commands.

Table 11-3. RTRV-ALM Descriptions (Contd)

Description	Meaning
`excessive holdover`	The system has been in holdover mode for more than 4 hours. This may cause degraded performance (high error rates) on the transmitted and/or received signals. Whenever this condition exists, the condition "`holdover mode active`" also exists. Likely Causes: See "`holdover mode active`."
`externalMinor`	The external minor alarm input (environmental alarm input 15) is active. Typically, this input will be connected to the power shelf and will indicate that the DC power or the cooling fan in a remote terminal cabinet has failed. The actual message that appears in the alarm and status report for this condition can be provisioned; this is the default message. See the **`rtrv-attr-env`** and **`set-attr-env`** commands.
`fan control relay failed`	The thermostat on the SYSCTL indicates that the cooling fan should be turned on, and the fan control relay on the SYSCTL CP failed to operate or the fan control relay output (backplane connector P62) does not connect to a fan. The system will continue to operate but might overheat if the SYSCTL controls a fan, leading to degraded or interrupted transmission and/or circuit pack failures. Likely causes: Telemetry output common pin on P62 is not grounded; SYSCTL CP failure.
`fan shelf failed`	The system has detected a failure of the DDM-2000 fan shelf. The system will continue to operate but it may overheat. The fan must be replaced within *4 hours* of the failure; otherwise service might be interrupted and/or circuit packs might fail. Likely causes: Filter needs replacing, a fan pack failed, fan shelf has lost one or both power feeders, or the fan shelf control board has failed.

Table 11-3. RTRV-ALM Descriptions (Contd)

Description	Meaning
holdover mode active	The system is in holdover synchronization mode. Likely causes: a. The system was manually switched to holdover mode (with the **switch-sync** command, or, in a central office system, with a TBOS control point) and the switch has not been reset b. The system automatically switched to holdover mode due to failure of the timing references, as follows: 1. The reference failures have not cleared. 2. The system is provisioned for nonrevertive synchronization mode switching. 3. The system is provisioned for External timing and no external timing references are available. 4. The system is provisioned for line-timed operation and the optical line or OLIU circuit pack has failed, or a message indicating an upstream clock problem has been received on the sync message bits of the optical line. (See the **rtrv-sync** command.) 5. The system is provisioned for sync message signaling, but the upstream system from which it line-times has not been provisioned for sync message signaling. The condition can be cleared by provisioning both systems the same. (See the **set-sync** and **rtrv-sync** commands.) The condition can be cleared by repairing at least one of the timing references (if both are failed) and resetting synchronization mode protection switch with the command **switch-sync:s=mode,pri=reset**. In a central office system, the synchronization mode can also be reset with a TBOS control point.
illegal CP type	An illegal or unknown circuit pack type has been inserted into the shelf. The circuit pack should be removed from the shelf.

Table 11-3. RTRV-ALM Descriptions (Contd)

Description	Meaning
`inc. DS1 sync. ref. AIS`	DS1 alarm indication signal (AIS) is being received from the DS1 synchronization reference signal. Likely causes: Failure of upstream equipment or facility (towards the DSX-1).
`inc. DS1 sync. ref. BER`	The bit error ratio (BER) in the DS1 synchronization reference signal exceeds 10^{-3}. Likely causes: Failure of upstream equipment or facility (towards the DSX-1).
`inc. DS1 sync. ref. EOOF`	Excessive out-of-frame (OOF) events were detected in the DS1 synchronization reference signal. Excessive OOF is defined as more than 512 out-of-frame events in one day. Likely cause: Failure of the incoming DS1 synchronization reference signal.
`inc. DS1 sync. ref. LOF`	The system is unable to frame on the DS1 synchronization reference signal. Likely causes: Upstream failure in the clock providing the reference signal; high bit error ratio on the received signal, caused by failure of the office timing supply that provides the DS1 timing reference; the system is provisioned for SF format on the specified DS1 synchronization reference signal and the received DS1 signal is in ESF format.
`inc. DS1 sync. ref. LOS`	At least 128 consecutive zeros were received in the DS1 synchronization reference signal, or the energy at the DS1 input is below a preset threshold. Likely causes: Failure of the office timing supply that provides the DS1 timing reference or failure of the connection to the timing supply.

Table 11-3. RTRV-ALM Descriptions (Contd)

Description	Meaning
`inc. DS1 sync. ref. OOL`	The incoming DS1 synchronization reference signal is out of lock (OOL). The frequency of the clock providing the DS1 reference signal is out of specification. Likely causes: Failure of the office timing supply that provides the DS1 timing reference.
`inc. (from fiber) DS3 AIS`	The system has detected DS3 alarm indication signal (AIS) in the DEMUX direction (that is, coming from the fiber) for the specified DS3 signal. Likely causes: The incoming DS3 signal at the far end is failed, or DS3 AIS is received from the DSX-3 at the far end.
`inc DS3 LOS`	At least 128 consecutive zeros were detected in the DS3 signal received from the DSX-3. Likely causes: Equipment failed or removed at DSX-3; DS3 input disconnected at the DSX-3 or at the DDM-2000 backplane.
`inc. (from fiber) DS3 OOF`	The system has detected a DS3 out-of-frame (OOF) condition in the DEMUX direction (that is, coming from the fiber) for the specified DS3 signal. This condition is reported only if the DS3 interface is provisioned in VM or VMR mode. See the **`set-t3`** and **`rtrv-t3`** commands. Likely causes: An out-of-frame DS3 signal incoming to the DSX-3 at the far end; failure of the DS3 CP at the far end or near end; the DS3 signal is looped at both ends.
`inc. (from DSX) DS3 sig. fail`	The bit error ratio (BER) in the incoming DS3 signal exceeds the provisioned failure threshold, 10^{-3} or 10^{-6}. Likely causes: Failure of the upstream equipment or facility (towards the DSX-3); cross talk in office wiring; unprotected failure of DS3 CP.
`inc. EC1 FERF`	The system has detected the EC-1 far-end receive failure (FERF) signal in the incoming EC-1 signal. Likely causes: The far end has detected an incoming signal failure on the specified EC-1 line. This may be caused by failure of the STS1E or 3STS1E CP at the near end, the STS1E or 3STS1E CP at the far end, or the transmit cable on the specified line.

Table 11-3. RTRV-ALM Descriptions (Contd)

Description	Meaning
inc. EC1 LOF	The system has detected a loss-of-frame (LOF) condition in an incoming EC-1 signal. LOF is defined as an out-of-frame (OOF) condition (five consecutive errored STS-1 framing patterns) that lasts for at least 3 milliseconds. Likely causes: Failure of the STS1E or 3STS1E or equivalent CP at the far end, failure of the STS1E or 3STS1E or equivalent CP at the near end, failure of the incoming cable, or a cable disconnect at the STSX-1 or shelf connector.
inc. EC1 LOS	The system has detected a loss-of-signal (LOS) condition on the EC-1 line. Likely causes: Failure of the incoming signal or cable from the STSX-1, failure of the STS1E or 3STS1E CP at the near end, or a cable disconnect at the STSX-1 or shelf connector.
inc. EC1 line AIS	The system has detected an EC-1 line alarm indication signal (AIS) on an incoming EC-1 line. Likely cause: Failure of an STS1E or 3STS1E CP at the far end.
inc. EC1 sig. degrade (BER)	The bit error ratio (BER) in the received EC-1 signal exceeds the provisioned threshold (10^{-5} to 10^{-9}). Likely causes: Failure of the STS1E or 3STS1E CP at the near end, failure of the incoming cable, cross talk in office wiring, or failure of the incoming signal from the STSX-1.
inc. OC12 FERF	The system has detected the OC-12 far end receive failure (FERF) signal in the incoming OC-12 signal. Likely causes: The far end has detected an incoming signal failure on the specified OC-12 line. This may be caused by failure of the OLIU CP at the near end, the OLIU CP at the far end, or the transmit fiber on the specified line.
inc. OC12 line AIS	The system has detected OC-12 line alarm indication signal (AIS) on an incoming OC-12 line. Likely cause: Failure of an OLIU CP at the far end.

Table 11-3. RTRV-ALM Descriptions (Contd)

Description	Meaning
inc. OC12 LOF	The system has detected a loss-of-frame (LOF) condition in an incoming OC-12 signal. LOF is defined as an out-of-frame (OOF) condition (four consecutive errored STS-1 framing patterns) that lasts for at least 3 milliseconds. Likely causes: Failure of the OLIU CP at the near end, failure of the OLIU CP at the far end, or failure of the receive fiber.
inc. OC12 LOS	The system has detected a loss-of-signal (LOS) condition on the OC-12 line. Likely causes: Failure of the OLIU CP at near end, failure of the OLIU CP at far end, or failure of the receive fiber.
inc. OC12 sig. degrade (BER)	The bit error ratio (BER) in the specified OC-12 line exceeds the provisioned soft error threshold (10^{-9} to 10^{-5}) but is below the hard error threshold of 10^{-3}. Likely causes: Failure of the OLIU CP at the near end, failure of the OLIU CP at the far end, failure of the receive fiber, or optical attenuator is being used when it should not be, or is not being used when it should be.
inc. OC12 sig. failed (BER)	The bit error ratio (BER) in the received OC-12 signal exceeds 10^{-3}. Likely causes: Failure of the OLIU CP at the near end, failure of the receive fiber, or failure of the OLIU CP at the far end.
inc. OC3 FERF	The system has detected the OC-3 far end receive failure (FERF) signal in the incoming OC-3 signal. Likely causes: The far end has detected an incoming signal failure on the specified OC-3 line. This may be caused by failure of the OLIU CP at the near end, the OLIU CP at the far end, or the transmit fiber on the specified line.

Table 11-3. RTRV-ALM Descriptions (Contd)

Description	Meaning
`inc. OC3 LOF`	The system has detected a loss-of-frame (LOF) condition in an incoming OC-3 signal. LOF is defined as an out-of-frame (OOF) condition (five consecutive errored STS-1 framing patterns) that lasts for at least 3 milliseconds. Likely causes: Failure of the OLIU CP at the near end, failure of the OLIU CP at the far end, or failure of the receive fiber.
`inc. OC3 LOP STS1` *x*	The system has detected a loss-of-pointer (LOP) condition. A valid STS-1 pointer could not be found for eight consecutive frames in the identified STS-1 signal. Likely causes: If this condition occurs on the STS-1 on both OC-3 lines, the likely cause is an unprotected failure of a MXRVO or DS3 CP at the far end. If this condition occurs only on one OC-3 line, the likely cause is failure of the OLIU CP at the near end or far end.
`inc. OC3 LOS`	The system has detected loss-of-signal (LOS) condition on the OC-3 line. Likely causes: Failure of the OLIU CP at near end, failure of the OLIU CP at far end, or failure of the receive fiber.
`inc. OC3 line AIS`	The system has detected OC-3 line alarm indication signal (AIS) on an incoming OC-3 line. Likely cause: Failure of an OLIU CP at the far end.
`inc. OC3 sig. degrade (BER)`	The bit error ratio (BER) in the specified OC-3 line exceeds the provisioned soft error threshold (10^{-9} to 10^{-5}) but below the hard error threshold of 10^{-3}. Likely causes: Failure of the OLIU CP at the near end, failure of the OLIU CP at the far end, failure of the receive fiber, or incorrect setting of the optical power switch on the OLIU CP.

Table 11-3. RTRV-ALM Descriptions (Contd)

Description	Meaning
`inc. OC3 sig. failed (BER)`	The bit error ratio (BER) in the received OC-3 signal exceeds 10^{-3}. Likely causes: Failure of the OLIU CP at the near end, failure of the receive fiber, or failure of the OLIU CP at the far end.
`inc. STS1 AIS`	The system has detected an incoming STS-1 alarm indication signal (AIS) in the active OC-3 or OC-12 line. or DS3 AIS toward the DSX and transmitting STS-1 yellow back toward the fiber from which the AIS is being received. Likely causes: Incomplete or incorrect cross-connect provisioning in an end-to-end network; unprotected removal or failure of a 3DS3 or OLIU CP at the far end.
`inc. STS1 LOP EC1` *x*	The system has detected a loss-of-pointer (LOP) condition. A valid STS-1 pointer could not be found for eight consecutive frames in the identified STS-1 signal. Likely causes: Failure of the far end or near end STS1E or 3STS1E circuit pack.
`inc. STS1 LOP OC12` *x*	The system has detected a loss-of-pointer (LOP) condition. A valid STS-1 pointer could not be found for eight consecutive frames in the identified STS-1 signal. Likely causes: If this condition occurs on the STS-1 on both OC-12 lines, the likely cause is an unprotected failure of a 3DS3 CP at the far end. If this condition occurs on only one OC-12 line, the likely cause is failure of the OLIU CP at the near end or far end.
`inc. STS1 LOP OC3` *x*	The system has detected a loss-of-pointer (LOP) condition. A valid STS-1 pointer could not be found for eight consecutive frames in the identified STS-1 signal. Likely causes: If this condition occurs on the STS-1 on both OC-3 lines, the likely cause is an unprotected failure of an MXRVO or a DS3 CP at the far end. If this condition occurs on only one OC-3 line, the likely cause is failure of the OLIU CP at the near end or far end.

Table 11-3. RTRV-ALM Descriptions (Contd)

Description	Meaning
inc. STS1 sig. degrade (BER)	For STS-1 path switched ring applications, the bit error ratio (BER) of the specified STS-1 signal exceeds the user-provisioned signal degrade threshold. Likely causes: Failure at a fiber or failure of an OLIU circuit pack at some point in the STS-1 path.
inc. STS1 unequipped	The system has detected the unequipped code (SONET path overhead signal code label byte=0) on an in-service STS-1 channel. Likely cause: An upstream STS-1 cross-connect has been deleted.
inc. STS1 sig. failed (BER)	For ring applications, the bit error ratio (BER) of the specified STS-1 signal exceeds the signal fail threshold (10^{-6}). Likely causes: Failure of the near end OLIU CP reporting the STS-1 failure, failure of the far end OLIU, or failure of the receive fiber if the OC-n is also reporting a failure.
inc. STS1 yellow	The system has detected an incoming STS-1 yellow signal inserted by the far-end path terminating equipment. Likely causes: Unprotected failure of a 3DS3 CP at the far end, unprotected failure of a 3DS3 CP at the near end.
inconsistent DCC values	The "User/Network" parameter values are set the same at both ends of the DCC.

Table 11-3. RTRV-ALM Descriptions (Contd)

Description	Meaning
inhibit switch	When associated with an OC-3 or OC-12 line, this message means that the identified line is not selected as the active receiving line, and a protection switch to make this the active receiving line will not be done. No further protection switching of specified line will be done until the protection switch is reset. Note: Line switching is unidirectional. Because of this, the specified line might still be active (if the far end is selecting the specified line to receive traffic), and the far end might still be free to switch the line it is selecting to receive traffic. See the **switch-line** command. When associated with a function unit slot, TSI slot, timing slot, or timing reference, this message means that the identified equipment or reference is not active, and protection switches to the identified equipment or reference will not be done until the protection switch is reset. See the **switch-fn** , **switch-tsi**, and **switch-sync** commands.
inhibit auto. OS messages	This message occurs when TL1 autonomous alarm reporting is inhibited by the TL1 **inh-msg** command. This message is cleared by enabling autonomous message reporting with the TL1 **alw-msg** command.
invalid CP switches	When associated with a TG slot, this message means that the timing mode switch settings on the TGS or TG3 (in OC-12 R7.0 and later) CP is invalid.
lockout of protection	When associated with an OC-3 line, this message means that the identified protection line is not selected as the active receiving line, and a protection switch to make this the active receiving line will not be allowed. Note: Line switching is unidirectional. Because of this, the specified line might still be active (if the far end is selecting the specified line to receive traffic), and the far end might still be free to switch the line it is selecting to receive traffic. The lockout will remain in effect until the protection switch is reset or until a protection switch "inhibit" request is entered. See the **switch-line** command.

Table 11-3. RTRV-ALM Descriptions (Contd)

Description	Meaning
`manual sync. mode switch`	The synchronization mode has been manually switched to holdover or free-running and will remain in that mode until the switch request is reset. See the **`switch-sync`** command.
`OHCTL CP failed`	Internal equipment failure of the OHCTL CP.
`OLIU CP failed`	Internal equipment failure of the specified OLIU CP.
`program installation IP`	This system is being used to install software into another system. If this procedure is interrupted prior to completion, the remote systems' control circuit packs will likely become inoperable until another install program attempt is successful. OC-12 Release 5.1 and later, this condition will appear if the network element determines that it is time to install a new software generic (originally, the action that caused this event to take place should have been the initiating of the **`apply`** command).
`section DCC channel failed`	The system cannot communicate with the far-end system through the SONET section data communications channel (DCC) or IAO LAN. Likely causes: SYSCTL or OHCTL CP failure, reset, or initialization at the far end; failed program installation at far end; program installation in progress at the far end; SYSCTL or OHCTL CP failure at the near end. When "Address=LAN, the likely causes are: LAN link integrity failure, excessive LAN retransmission attempts, collisions...
`SYSCTL CP failed`	Internal equipment failure of the SYSCTL CP. The system has determined that some part of the SYSCTL CP has failed. Note that some types of failures cannot be reported since the SYSCTL CP cannot function under these conditions.
`TGS CP failed`	Internal equipment failure of the specified TGS CP, or the systems at both ends of the span are line-timed from each other.
`TG3 CP failed`	Internal equipment failure of the specified TG3 CP. This timing pack is available with OC-12 Release 7.0 and later

Table 11-3. RTRV-ALM Descriptions (Contd)

Description	Meaning
TSI CP failed	Internal equipment failure of the TSI CP.
unexpected CP present	A circuit pack has been installed into the MAIN-A slot. The circuit pack should be removed from the shelf.
unexpected CP switches	When associated with the SYSCTL or OHCTL slot, this message means that an invalid switch setting has been selected on the CP, or that some of the unused switches are not in the prescribed position. For OLIU slots, it indicates that the optical power switch on the OLIU CP was different from what it was before the OLIU CP was replaced. For DS3 slots, this message means that a change in a circuit pack switch setting was made. When associated with a TG slot, this message means: 1. The timing mode switch settings on the TGS or TG3 (OC-3 R13.0, OC-12 R7.0, and later) CP are: a. different from those on the companion TGS or TG3 CP, or b. different from what they were before the TGS or TG3 CP was replaced, or 2. The DS1 format or line coding switches on the TGS or TG3 CP are not the same as they were before the TGS or TG3 CP was replaced. When associated with a function unit (FN) slot, this message means that the optical power switch on the 21G OLIU CP is different from what it was before the 21G OLIU CP was replaced.
unexpected CP type	When associated with a function unit (FN) slot, this message means that a different but supported circuit pack is inserted in a slot already provisioned. When associated with an OC12 system, this message means that a OLIU, 3DS3, or 3STS1E CP is inserted in a slot provisioned for a different type of circuit pack.

NAME

rtrv-hsty:Retrieve History

INPUT FORMAT

`rtrv-hsty;`

DESCRIPTION

This command displays an event-history report. This report contains a list of the most recent system events. This report contains up to 500 events. The events are listed in last-in, first-out order and are date- and time-stamped.

The output report appears as follows:

```
/* Maintenance History Report
============================================================
Date   Time     Sys.Alm.     Source      Event
                 Level                   Description
============================================================
MM-DD HH:MM:SS  alarm        address     description
                  .
                  .
                  .
MM-DD HH:MM:SS  alarm        address     description
*/
```

The output parameters are:

`Date`	Month (MM) and day (DD) of the event.
`Time`	Time (hours, minute, seconds) of event occurrence. Time stamps reflect the time the entry is made. Entries are added to the history report BEFORE any applicable holdoff delays and AFTER any applicable clear delays.
`System Alarm Level`	Alarm level corresponds to the system alarm level at the time immediately after the event occurred. Alarm level is the level of the highest active or pending alarm/status condition. The alarm level is reported as if the holdoff delay was zero. Additionally, the alarm level column may show CR, MJ, MN, or PMN alarms for troubles that never really became alarms, since holdoff delays may prevent the troubles from reaching an alarm condition.

The alarm level may be one of the following:

`CRITICAL`	Critical Alarm
`MAJOR`	Major Alarm
`MINOR`	Minor Alarm
`PWR MINOR`	Power Minor Alarm
`abnormal`	Abnormal condition
`ne-acty`	Near-End Activity
`status`	Status condition
—	No active alarm or status condition in the system.

`Source` The source of the event. An event source may be the entire system or a slot, a channel, or an operations interface. If security is enabled, it may also be a CIT or a login name. Refer to "Commands" and Table 11-1 at the beginning of this section for the addresses of lines, slots, ports, channels, and operations interfaces.

`Event Description` Table 11-4 lists the meaning and likely cause of each of the messages that appear in the maintenance history report.

In addition to the messages listed here, any of the messages that appear in the alarm and status report can appear in the history report to record the onset of alarm and status conditions.

Also, all CIT and TL1 commands that affect the state of the system (provisioning commands; protection switching commands; loopbacks; transmission, alarm, and telemetry tests) will appear in the report.

NOTE:
Any messages that appear in the RTRV-ALM report may also appear in the history report.

Table 11-4. RTRV-HSTY Descriptions

Description	Meaning
`-48V power/fuse good`	A failed -48 volt power feeder or a failed fuse on the user panel has been repaired.
`CP removed`	A circuit pack has been removed from the specified slot.
`3DS3 CP good`	The failure of the specified circuit pack has cleared.
`3DS3 CP inserted`	A circuit pack was inserted into the shelf.
`3STS1E CP inserted`	A circuit pack was inserted into the shelf.
`AC power failed-FE clrd`	The AC power supply to a remote terminal cabinet has been restored.
`AC power good`	The AC power supply to the shelf has been restored.
`APS - CP failed`	An automatic protection switch was done because the system detected a circuit pack failure.
`APS channel good`	A failure of the SONET automatic protection switching channel has cleared.
`APS - sig. degraded`	An automatic protection switch was done because the system detected a degraded signal on the OC-N line or path.
`APS - sig. failed`	An automatic protection switch was done because the system detected a failure of the OC-N line or path (incoming AIS, loss of signal, or bit error rate higher than 10^{-3}).
`auto sync. mode switch`	An automatic protection switch of the synchronization mode is active. When the failure that caused the switch to be done clears, the switch will be reset automatically if automatic mode switching is enabled. (See the **`set-sync`** and **`rtrv-sync`** commands.)
`CIT timeout`	A craft interface terminal (CIT) session was automatically terminated because there was no activity on the CIT for the provisioned time. (See the **`set-secu`** command.)
`control`**`n`** `rlsd`	The system has released the specified miscellaneous discrete environmental control because it has been requested to do so through the serial telemetry or discrete telemetry interface. This message will appear only in a remote terminal. Any name may be provisioned in place of the `control`**`n`** part of this message.
`cpy-prog compl.`	The software copy procedure has been completed. This message will show at the source NE.

Table 11-4. RTRV-HSTY Descriptions (Contd)

Description	Meaning
disconnect	The craft interface terminal has been disconnected.
dlt-ulsdcc compl.	Starting with OC-12 Release 7.0 and later TARP releases, this event will indicate the deletion of provisionable parameters of Layer 4 (that is, deletion of TARP Adjacent NE from the Manual Adjacency list, deletion of a TARP Data Cache entry).
DS1 sync. ref. port in service	A DS1 External timing reference was automatically put in the in-service state because an incoming DS1 signal was detected.
DS3 port in service	A DS3 port was put in the in-service state. This happens automatically when an incoming signal is detected (coming from the DSX) unless the port has been provisioned to the not monitored state.
EC1 port in service	An EC1 port has been placed in the in-service state.
enable auto OS messages	Autonomous OS message reporting has been enabled with the TL1 command **alw-msg**.
environment**n** rlsd	The specified miscellaneous discrete environment alarm input point has been released, indicating that an environmental alarm or status condition has cleared. This message will appear only in a remote terminal. Any name may be provisioned in place of the environment**n** part of this message.
externalMinor clrd	The external minor alarm condition has cleared.
fan control relay good	The fan control relay on the SYSCTL CP was failed but is now operating properly to turn on the fans.
fan shelf good	A fault on the fan shelf has been cleared.
frequency error clrd	The frequency offset failure has been cleared.
holdover mode clrd	The system is no longer in holdover timing mode. It has switched from holdover mode to the provisioned timing mode (either LoopTimed or phaselocked to an External DS1 timing reference).
inc. DS1 sync. ref. good	A failure of the External DS1 timing reference is cleared.
inc. (from fiber) DS3 AIS clrd	The system is no longer detecting DS3 AIS (alarm indication signal) in the DEMUX direction (that is, coming from the fiber).
inc. DS3 good	A failure of the DS3 signal coming from the DSX is cleared.

Table 11-4. RTRV-HSTY Descriptions (Contd)

Description	Meaning
inc. (from fiber) DS3 OOF clrd	A DS3 out-of-frame (OOF) condition in the DEMUX direction (coming from the fiber) is cleared.
inc. EC1 FERF clrd	The system is no longer detecting an EC-1 far end receive signal failure (FERF) signal.
inc. EC1 good	A failure of the EC-1 signal has been cleared.
inc. EC1 line AIS clrd	The EC-1 alarm indication signal (AIS) is no longer being received. A downstream failure has cleared.
inc. EC1 sig. degrade (BER) clrd	A failure of the specified EC-1 signal has cleared.
inc. OC12 FERF clrd	The system is no longer detecting the OC-12 far end receive failure (FERF) signal.
inc. OC12 good	A failure of the OC-12 signal from the DSX has been cleared.
inc. OC12 LOP STS1 #*x* clrd	The system is no longer detecting a loss-of-pointer (LOP) condition on the specified STS-1 signal.
inc. OC12 sig. degrade clrd	A failure of the specified OC-12 signal has cleared. OC-12 line AIS and/or OC-12 line FERF conditions may still be present on the specified OC-12 line. The OC-12 LOP condition may still be present for one or more of the STS-1 signals in the OC-12 line.
inc. OC12 line AIS clrd	The system is no longer detecting the OC-12 alarm indication signal (AIS) on the specified OC-12 line.
inc. OC3 FERF clrd	The system is no longer detecting the OC-3 far end receive failure (FERF) signal.
inc. OC3 good	A failure of the OC-3 line has been cleared.
inc. OC3 LOP STS1 #*x* clrd	The system is no longer detecting a loss-of-pointer (LOP) condition on the specified STS-1 signal.

Table 11-4. RTRV-HSTY Descriptions (Contd)

Description	Meaning
`inc. OC3 sig. degrade clrd`	A failure of the specified OC-3 signal has cleared. OC-3 line AIS and/or OC-3 line FERF conditions may still be present on the specified OC-3 line. The OC-3 LOP condition may still be present for one or more of the STS-1 signals in the OC-3 line.
`inc. OC3 line AIS clrd`	The system is no longer detecting the OC-3 alarm indication signal (AIS) on the specified OC-3 line.
`inc. STS1 AIS clrd`	The STS-1 alarm indication signal (AIS) is no longer being received. An upstream failure (in the MUX direction) has cleared.
`inc. STS1 LOP EC1 clrd`	A loss-of-pointer condition on the STS-1 signal of the EC-1 line has been cleared.
`inc. STS1 LOP OC12 slot clrd`	The system is no longer detecting a loss-of-pointer (LOP) condition on the specified STS-1 signal.
`inc. STS1 LOP OC3 slot clrd`	The system is no longer detecting a loss-of-pointer (LOP) condition on the specified STS-1 signal.
`inc. STS1 sig. degrade clrd`	A failure of the specified STS-1 signal has cleared.
`inc. STS1 sig. failed clrd`	A failure of the specified STS-1 signal has cleared.
`inc. STS1 unequipped clrd`	A failure of the specified STS-1 signal has cleared.
`inc. STS1 yellow clrd`	The STS-1 yellow signal is no longer being received.
`ins-prog compl.`	The software installation procedure has been completed. This message will show at the source NE.
`login:` *`login_id`*	A login session with a user's login identification has been started on the specified CIT port.
`login:` *`login_id DENY`*	A login session was attempted but denied because of an invalid login and password pair, or the system was in Lockout state.
`logout:` *`login_id`*	A login session with a user's login identification has ended on the specified CIT port.
`logout:` *`login_id DISCONNECT`*	A login session with a user's login identification has ended by a disconnect on the specified CIT port.

Table 11-4. RTRV-HSTY Descriptions (Contd)

Description	Meaning
`main-{1,2} protection switch`	Equipment switching in a ring application has occurred due to equipment failure.
`OHCTL CP good`	The internal equipment failure of the OHCTL circuit pack has cleared.
`OLIU CP good`	The failure of the specified circuit pack has cleared.
`OLIU CP inserted`	A circuit pack was inserted into the shelf.
`remote session logout`	A remote CIT session (set up by the `rlgn` command) has been terminated. This may have been caused by normally logging out of the remotely accessed far end session, or once in the far end session, the user toggled back and logged out of the local session.
`remote session terminated`	A remote CIT session (set up by the `rlgn` command) has been abnormally terminated. This may have been caused by a failure of the controller, circuit pack failure, timeout, or any other abnormal termination at the far end NE.
`reset`	The system software program has been reset.
`rlgn:`*`login_id DENY`*	A remote login session was attempted but denied because of an invalid login and password pair, or the DCC connecting the remote system was in Lockout state.
`section DCC channel good`	The failure of the SONET section data communications channel or IAO LAN has cleared.
`STS1 channel in service`	An STS1 channel was put in the in-service state. This happens automatically when a "good" signal is detected on the channel (neither AIS, unequipped signal, nor "loss of pointer" condition is present), unless the channel has been provisioned to the "not monitored" state.
`switch reset`	— The system has switched from holdover synchronization mode to the provisioned synchronization mode (`LoopTimed` or `phaselocked` to an `External` DS1 timing reference). or — A manually initiated protection switch has been reset (by the **`switch-sync`**, **`switch-line`**, **`switch-fn`**, or **`switch-tsi`** command), or by removing a CP from the shelf.

Table 11-4. RTRV-HSTY Descriptions (Contd)

Description	Meaning
`sysctl crs map recovered`	A read failure of the cross-connection data base occurred during restart, but the backup copy was recovered and is being used.
`sysctl crs map initialized`	A read failure of the cross-connection data base occurred during restart, and recovery using backup copies also failed. The cross-connection map was initialized.
`sysctl channel states initialized`	A read failure of the channel state data base occurred during restart, and recovery using backup copies also failed. The channel state data on SYSCTL was used.
`sysctl port states initialized`	A read failure of the port state data base occurred during restart, and the recovery using backup copies also failed. The port state data on SYSCTL was used.
`TGS CP good`	The failure of the specified circuit pack has cleared.
`TGS CP inserted`	A circuit pack was inserted into the shelf.
`TG3 CP good`	The failure of the specified circuit pack has cleared.
`TG3 CP inserted`	A circuit pack was inserted into the shelf.
`TSI CP good`	The failure of the specified circuit pack has cleared.
`TSI CP inserted`	A circuit pack was inserted into the shelf.

A SONET Overview

A

Table of Contents

Overview A-1

History A-1

Basic Purpose A-2

Technical Overview A-2

- SONET Signal Hierarchy A-2
- SONET Layers A-4
- SONET Frame Structure A-6
- Section Overhead A-6
- Line Overhead A-7
- Path Overhead A-8
  - STS-1 Path Overhead A-8
  - VT Path Overhead A-9
- SONET Multiplexing Procedure A-10
- SONET Demultiplexing Procedure A-12
- SONET Digital Multiplexing Schemes A-14
  - Asynchronous Multiplexing A-14
  - Synchronous Multiplexing A-15
- Virtual Tributary Signals A-15
- Concatenated Mode A-16

SONET Interface A-17

- SONET Payloads A-18
- Higher Rate Transport A-19

Conclusion A-19

Table of Contents

A SONET Overview

A

Overview

This section briefly describes the Synchronous Optical Network (SONET).

History

In the early 1980's, the American National Standards Institute (ANSI) recognized the need for an optical signal standard for future broadband transmission. The ANSI T1X1 subcommittee began working on optical signal and interface standards in 1984. In 1985, Bellcore proposed a network approach to fiber system standardization to T1X1. The proposal suggested a hierarchical family of signals whose rates would be **integer multiples** of a basic modular signal. The proposal further suggested a synchronous multiplexing technique, leading to the coining of the term *Synchronous Optical NETwork* (SONET).

The International Telephone and Telegraph Consultative Committee (CCITT) first showed interest in 1986. Conferences held through 1987 and 1988 resulted in coordinated specifications for both the American National Standard (SONET) and the CCITT-International Standard, Synchronous Digital Hierarchy (SDH). Approval of both sets of standards occurred in late 1988.

Basic Purpose

The basic purpose of SONET is to provide a standard synchronous optical hierarchy with sufficient flexibility to accommodate digital signals that currently exist in today's network as well as those planned for the future.

SONET currently defines standard rates and formats and optical interfaces. These and other related issues continue to evolve through the ANSI committees. SONET ultimately will permit an optical midspan meet in a multivendor environment.

The American National Standard defines the following:

- Optical parameters (*ANSI** T1.106-1988)
- Electrical parameters (*ANSI* T1.102-1993 Draft)
- Multiplexing schemes to map existing digital signals (for example, DS1, DS2, and DS3) into SONET payload signals (*ANSI* T1.105-1991)
- Criteria for optical line automatic protection switch (APS) (*ANSI* T1.105-1991)
- Overhead channels to support standard operation, administration, maintenance, and provisioning (OAM&P) functions (*ANSI* T1.105-1991).

*

Technical Overview

SONET Signal Hierarchy

The SONET signal hierarchy is based on a basic "building block" frame called the synchronous transport signal - level 1 (STS-1), as shown in Figure A-1 on the following page. The STS-1 frame has a reoccurring rate of 8000 frames per second. Each frame is 125 microseconds.

The STS-1 frame consists of:

- 90 columns (each column is an 8-bit byte)
- 9 rows.

* Registered trademark of America National Standards Institute

The STS-1 frame is transmitted serially starting from the left with row 1 column 1 on through column 90, then row 2 column 1 through 90, continuing on, row-by-row, until all 810 bytes (9 X 90) of the STS-1 frame have been transmitted.

Since each STS-1 frame consists of 810 bytes and each byte has 8 bits, the frame contains 6480 bits a frame. There are 8000 STS-1 frames per second, at the STS-1 signal rate of 51,840,000 (6480 X 8000) bits a second.

The first three columns in each of the nine rows carry the SECTION and LINE overhead bytes. Collectively, these 27 bytes are referred to as transport overhead.

The remainder of the frame, columns 4 through 90, is reserved for payload signals (for example, DS1, DS3, and path overhead) and is referred to as the STS-1 synchronous payload envelope (STS-1 SPE). The optical counterpart of the STS-1 is the optical carrier level 1 signal (OC-1), which is the result of a direct optical conversion. The electrical counterpart of the STS-1 is the electrical carrier level 1 signal (EC-1).

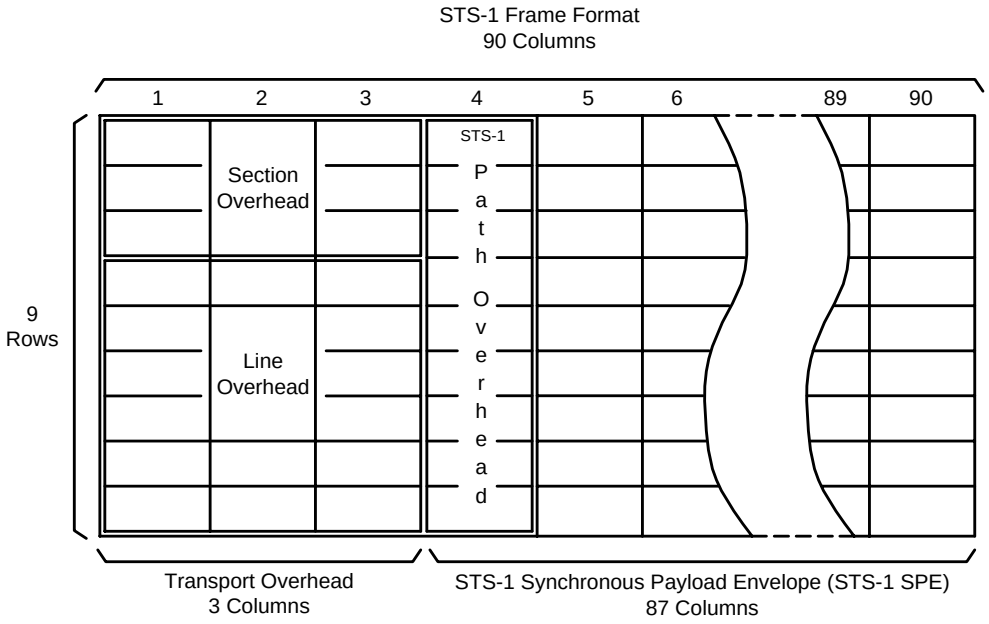


Figure A-1. SONET STS-1 Frame — Simplified Version

SONET Layers

SONET divides its processing functions into three layers. These three layers are associated with equipment that reflects the natural divisions in network spans. Figure A-2 shows these defined layers in a signal path. They include:

- **SECTION** and **Section Terminating Equipment** - the transmission spans between lightwave terminating equipment and the regenerators. The spans between the regenerators are also considered sections. Section terminating equipment provides regenerator functions and terminates the section overhead to provide single-ended operations and section performance monitoring.
- **LINE** and **Line Terminating Equipment** - the transmission span between terminating equipment (STS-1 cross-connections) that provides line performance monitoring. If there are no intervening repeaters, the line terminating equipment also functions as section terminating equipment.
- **STS-1 and VT Path** and **Path Terminating Equipment** - the transmission span for an end-to-end tributary (DS1 or DS3) signal that provides functions including signal labeling and path performance monitoring for signals as they are transported through a SONET network. STS-1 path terminating equipment can also provide cross-connections for lower rate (that is, DS1) signals. A virtual tributary (VT) is a sub-DS3 payload and is described later in more detail.

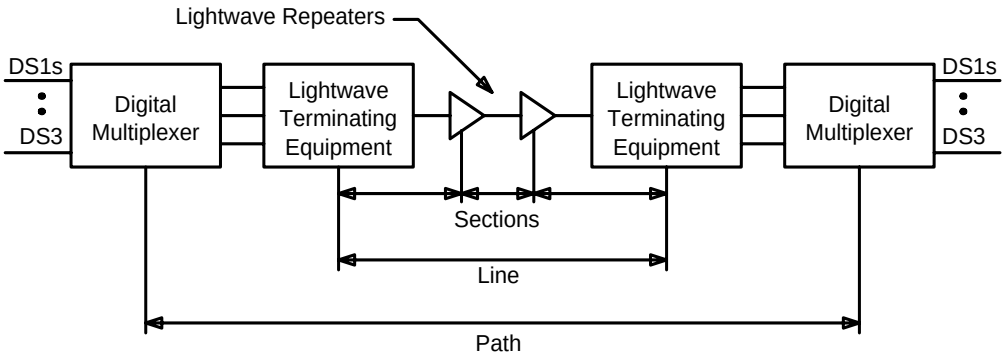


Figure A-2. Section, Line, and Path Definitions

Each SONET layer has a set of overhead bytes as shown in Figure A-3. These bytes carry information used by various network elements.

- **Section Overhead** contains information that is used by all SONET equipment including repeaters.
- **Line Overhead** is used by all SONET equipment except repeaters.
- **Path Overhead** is carried within the payload envelope.
  - **STS-1 path overhead** remains with the STS-1 SPE until its asynchronous signal is extracted (for example, DS-3) or until its individual VT1.5 signals are demultiplexed.
  - **VTN (N= 1.5, 2, 3, or 6) path overhead** remains with the VTN until its asynchronous signal is extracted.

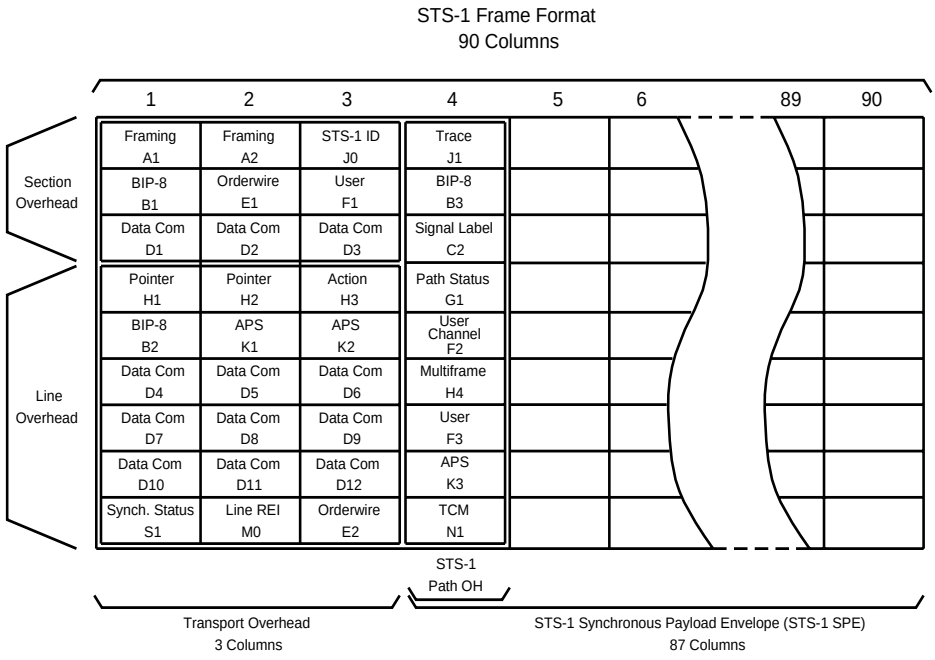


Figure A-3. SONET Frame Format

SONET Frame Structure

The following pages provide more detailed information on the function of various overhead bytes for each SONET layer.

Section Overhead

- Framing (A1, A2)
  - — Provides framing for each STS-1.
- STS-1 ID (J0)
  - — Provides the order of appearance in a byte-interleaved STS-*N* frame; for example, STS-1 #1, STS-1 #2.....STS-1 #48. In future applications, this byte will provide a section trace function. For information on STS-*N* signals, see the "Higher Rate Transport" part of this section.
- Section Bit-Interleaved Parity (BIP-8) (B1)
  - — Provides SECTION performance monitoring and is calculated over all bits of the previous STS-*N* frame. Defined only for STS-1 #1 of an STS-*N* signal.
- Section Orderwire (E1)
  - — Provides a local orderwire for voice communication channel between section terminating network elements, such as repeaters. Defined only for STS-1 #1 of an STS-*N* signal.
- Section User Channel (F1)
  - — Set aside for the user's purpose. Defined only for STS-1 #1 of an STS-*N* signal.
- Section Data Communications Channel (D1, D2, D3)
  - — Is a 192 kb/s message-based channel. Used for alarms, maintenance, control, monitoring, and other communication needs between section terminating equipment. Defined only for STS-1 #1 of an STS-*N* signal.

Line Overhead

- Line Pointer (H1, H2)
  - — Two bytes indicate the offset in bytes between the pointer action byte (H3) and the first byte (J1) of the STS-1 synchronous payload envelope (SPE).
- Pointer Action (H3)
  - — One byte is allocated for frequency justification.
- Line Bit-Interleaved Parity (BIP-8) (B2)
  - — This byte is for line performance monitoring. This byte is provided in all STS-1 signals within an STS-*N* signal.
- Line Automatic Protection Switching (APS) (K1, K2)
  - — Two bytes used for APS signaling between line level entities. In addition, bits 6, 7, and 8 of K2 are used for line alarm indication signal (AIS) and line far-end receive failure (FERF). Defined only for STS-1 #1 of an STS-*N* signal.
- Line Data Communications Channel (D4 - D12)
  - — Is a 576 kb/s message-based channel.
- Synch. Status (S1)
  - — In STS-1 #1, the S1 byte is for synchronization status messages, and only bits 5 through 8 are used.
- Line REI (M0)
  - — The M0 byte is for STS-1 line far-end block error (FEBE), and only bits 5 through 8 are used.
- Line Orderwire (E2). Defined only for STS-1 #1 of an STS-*N* signal.
  - — One byte is allocated to be used as an express orderwire between line terminating equipment.

Path Overhead

There are two types of path overheads:

— STS-1 path overhead

— VT path overhead.

STS-1 Path Overhead

The STS-1 path overhead is assigned to and remains with the STS-1 SPE until the payload is extracted and is used for functions that are necessary to transport all synchronous payload envelopes.

- STS-1 Path Trace (J1)
  - — Repetitively transmits a 64 byte, fixed length, string so that an STS-1 path receiving terminal can verify its continued connection to the intended transmitter.
- STS-1 Path Bit-Interleaved Parity (BIP-8) (B3)
  - — Provides each STS-1 path performance monitoring. This byte is calculated over all bits of the previous STS-1 SPE before scrambling.
- STS-1 Path Signal Labels (C2)
  - — Indicates the construction of the STS-1 SPE. A value of 00000000 indicates an unequipped STS-1 SPE. Values for various payload mappings are defined in TR-NWT-000253, Issue 2.
- STS-1 Path Status (G1)
  - — Conveys the STS-1 path terminating status, far end block errors (FEBE), and yellow alarm signal conditions back to an originating STS-1 path terminating equipment.
- STS-1 Path User Channel (F2, F3)
  - — User communication channel between Path elements.
- VT Multiframe Indicator (H4)
  - — Provides a general multiframe indicator for VT-structured payloads.
- STS-1 Path Automatic Protection Switching (K3)
  - — Path Automatic Protection Switching
- TCM - Tandem Connection Maintenance (N1)
  - — Bits 1-4 used for incoming error monitoring. Bits 5-8 used as communications channel.

VT Path Overhead

There is one byte of VT path overhead called V5. It occurs on every fourth frame; that is, 2000 times a second.

This byte provides for VT paths the same functions that B3, C2, and G1 provide for STS paths, namely:

- Error checking
- Signal label
- Path status.

The bit assignments of the VT path overhead are specified in the following list and are illustrated in Figure A-4:

— Bits 1 and 2 are used for error performance monitoring (BIP-2).

— Bit 3 is a VT path far-end-block-error (FEBE) indication that is sent back toward an originating VT PTE when errors are detected by the BIP-2.

— Bit 4 and Bit 8 are used for remote defect indication (RDI)

— Bits 5 through 7 provide a VT signal label.

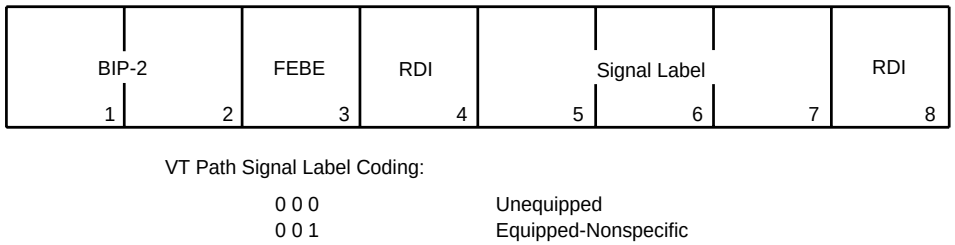


Figure A-4. VT Path Overhead Byte

SONET Multiplexing Procedure

SONET has provisions for multiplexing asynchronous DS1s, synchronous DS1s, and asynchronous DS3s. Refer to Figure A-5 and Figure A-6.

The first stage in multiplexing is mapping the input DS1 or DS3 tributary. In the case of DS1 inputs, three time slots (DS0s) are added to the incoming signal thus becoming a VT1.5. An asynchronous DS1 that fully meets the specified rate is mapped into the VT1.5 SPE as clear channel input since no framing is needed.

- Each VT1.5 carries a single DS1 payload.
- Four VT1.5s are bundled into a VT group (VT-G).
- Seven VT-Gs are byte-interleaved into an STS-1 frame.

The VT-G to-STS-1 multiplex is a simple byte-interleaving process, so individual VT signals are easily observable within the STS-1. Thus, cross-connections and add/drop can be accomplished without the back-to-back multiplexing/multiplexing steps required by asynchronous signal formats. The structured VTs are now multiplexed into the STS-1 SPE, and the path, line, and section overhead are added. The final multiplexing, as shown in Figure A-5, provides the scrambled STS-*N* signal to the optical conversion stage.

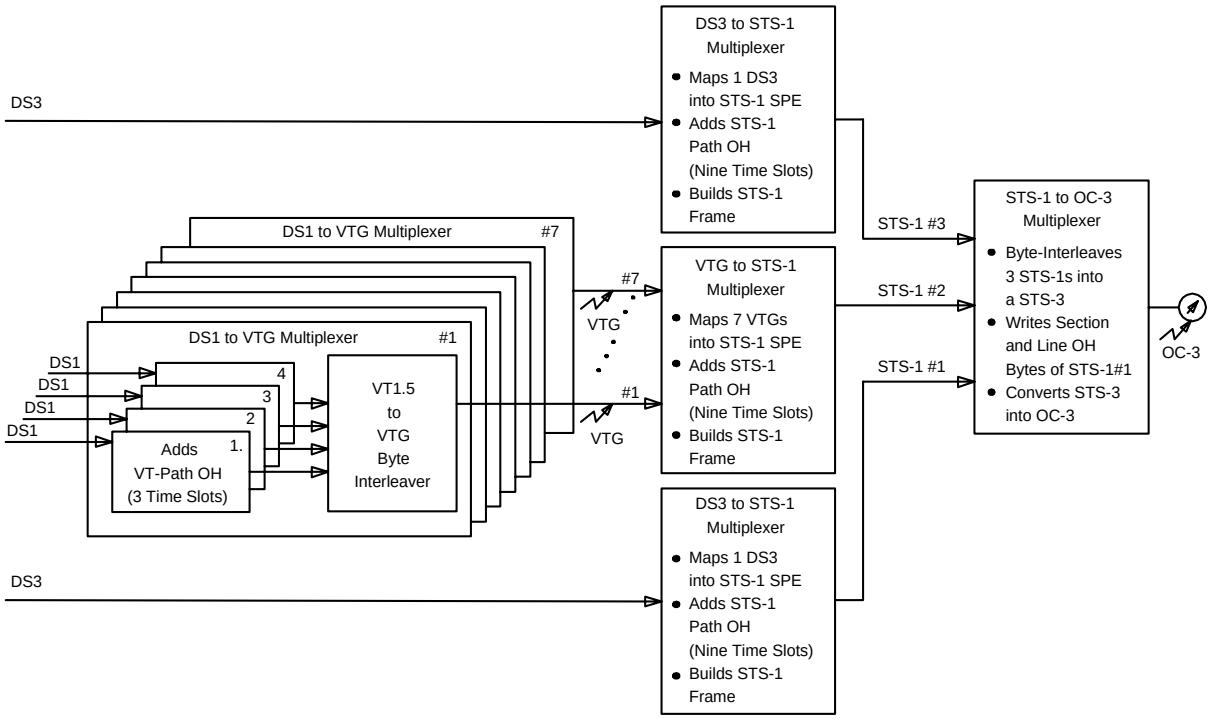


Figure A-5. SONET Multiplexing Procedure

SONET Demultiplexing Procedure

As shown in Figure A-6, demultiplexing is the inverse of multiplexing. The unscrambled STS-1 signal from the optical conversion stages is processed to extract the section and line overhead and accurately locate the SPE. The next stage processes the path overhead and demultiplexes the VTs. A standard DS3 signal will be provided to the asynchronous network after path overhead processing. For DS1 signals, the individual DS1 VTs are then processed to extract VT overhead and, via the VT pointer, accurately locate the DS1 SPE. Finally, desynchronization of the DS1 SPE provides a standard DS1 signal to the asynchronous network.

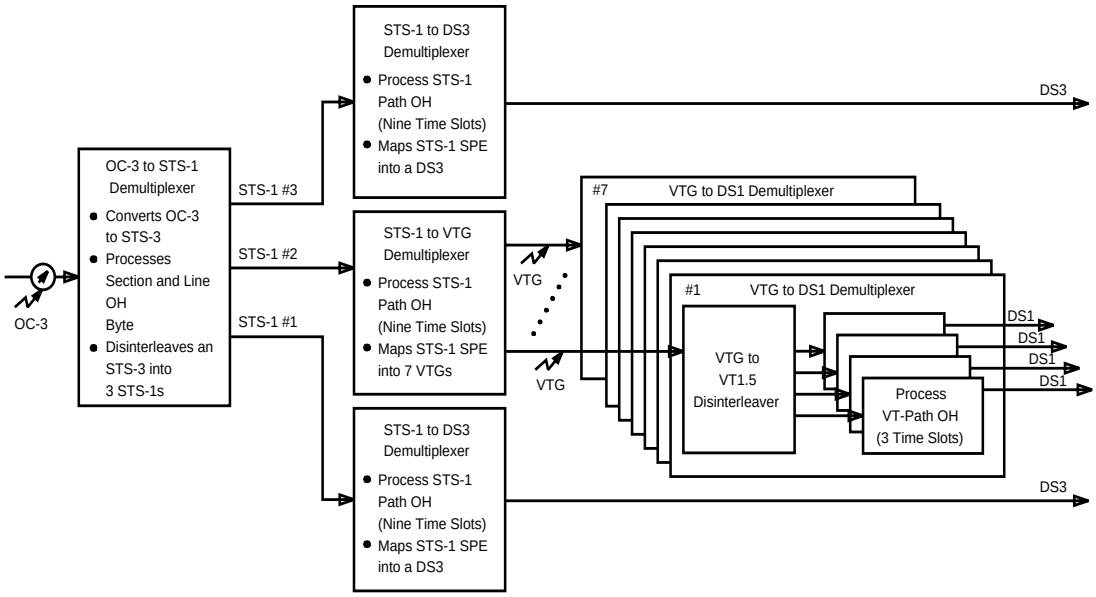


Figure A-6. SONET Demultiplexing Procedure

Two key points should be noted at this time. First, the SONET frame is a fixed time (125 µs) and no bit-stuffing is used. Second, as shown in Figure A-7, the synchronous payload envelope can *float* within the frame using byte-stuffing. This is to permit compensation for small variations in frequency between the clocks of the two systems that may occur if the systems are independently timed (plesiochronous timing). The SPE can also drift across the 125-µs frame boundary. SONET STS pointers are used to locate the SPE relative to the transport overhead.

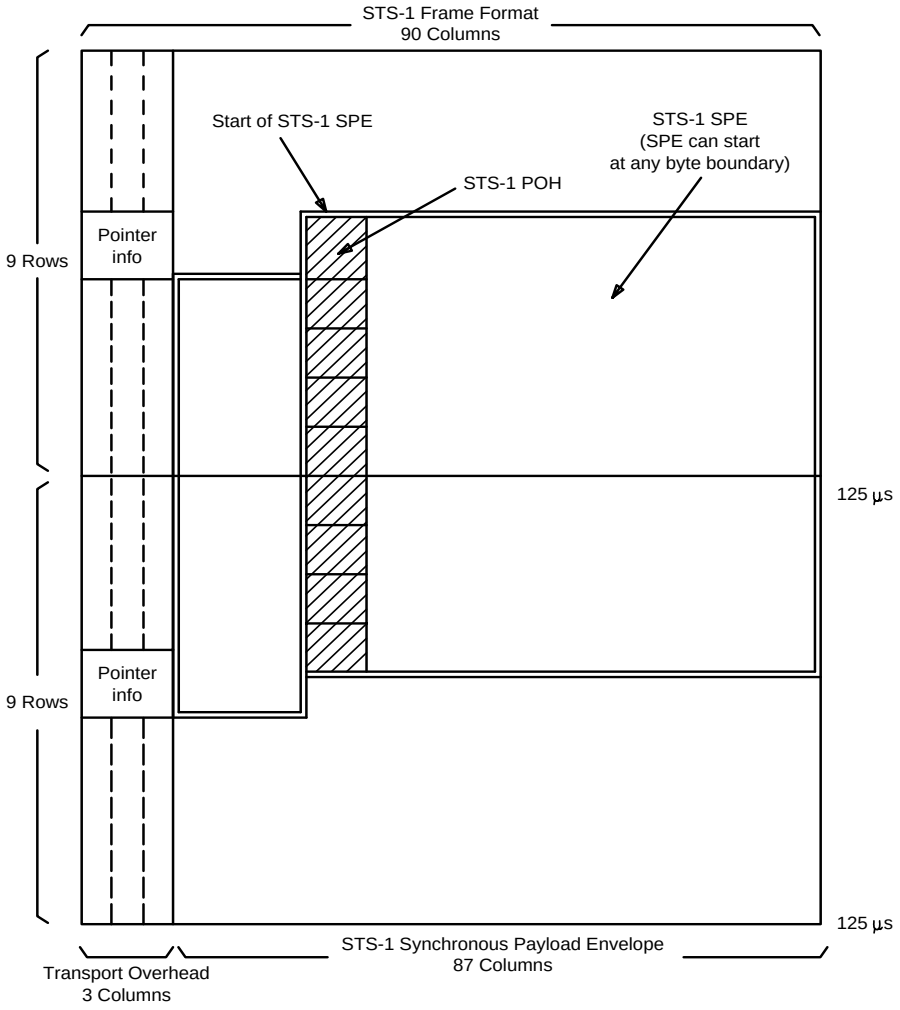


Figure A-7. STS-1 Synchronous Payload Envelope in Interior of STS-1 Frame

SONET Digital Multiplexing Schemes

Asynchronous Multiplexing

Currently, fiber optic facilities are primarily used to carry DS3 signals. The DS3 signal consists of a combination of the following payload signals:

- 28 DS1s
- 14 DS1Cs
- 7 DS2s.

Typically, 28 DS1 signals are multiplexed into a DS3 signal, using an M13 format. Refer to Figure A-8. M13 format is a process that includes bit-interleaving four DS1 into a DS2 signal and then bit-interleaving seven DS2 signals into a DS3. The DS3 rate is not a direct multiple of the DS1 or the DS2 rates due to the bit-stuffing synchronization technique used in asynchronous multiplexing.

Identification of DS0s contained in any DS-*N* signal, except DS1, is complex and DS0s cannot be directly extracted. Thus, an asynchronous DS3 signal must be demultiplexed down to the DS1 level to access and cross-connect DS0 and DS1 signals.

Another disadvantage of the M13 format is there is no end-to-end overhead channel for use by OAM&P groups.

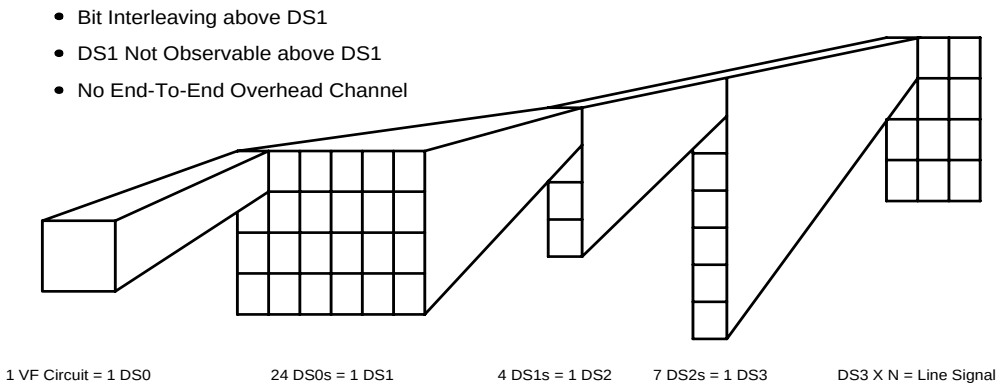


Figure A-8. Asynchronous Multiplexing

Synchronous Multiplexing

SONET's method of *byte-interleaving* DS1s to a higher signal rate permits economical extraction of a single DS1 without the need to demultiplex the entire STS-1 SPE. In addition, SONET provides overhead channels for use by OAM&P groups.

In SONET, a single asynchronous DS3 signal is mapped into an STS-1 SPE (Figure A-9).

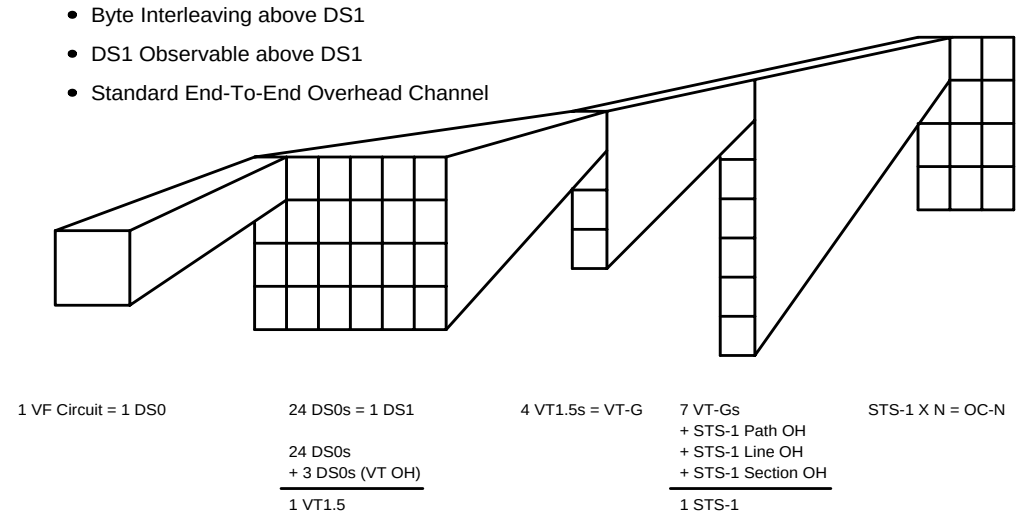


Figure A-9. Synchronous Multiplexing

Virtual Tributary Signals

Sub-DS3 asynchronous signals (DS1, DS1C, DS2 and E1) are *byte-interleaved* into a digital signal called a virtual tributary (VT). The VT is a structure designed for the transport and switching of sub-DS3 payloads. Like the STS-1 signal, the VT signal has a floating pointer that allows each VT SPE to move within the VT structure. There are four sizes of virtual tributaries (VT1.5, VT2, VT3, VT6). Higher rate payloads are transported as one or more concatenated STS-1 signals.

Concatenated Mode

For services requiring multiples of the STS-1 rate, STS-1 path payloads may be shared to create a single broadband payload called a concatenated STS-*N*c (OC-*N*c). STS-1 signals are mapped into an STS-*N*c SPE and transported as a concatenated STS-*N*c signal. This STS-*N*c signal can be carried by an STS-*N* or OC-*N* (or higher level) line signal.

The STS-*N* signal is multiplexed, switched, and transported through the network as a single entity. A concatenation indicator, used to show that the STS-1s of the STS-*N*c signal are linked together, is contained in the STS-1 payload pointer of all but the first STS-1. The line and section overhead is sent on the first STS-1 and the payload pointer for the first STS-1 is applied to all STS-1 signals in the concatenated signal.

Figure A-10 shows an example of an STS-3c SPE. It consists of 3 x 87 columns and 9 rows of bytes. The order of transmission is row by row, from left to right.

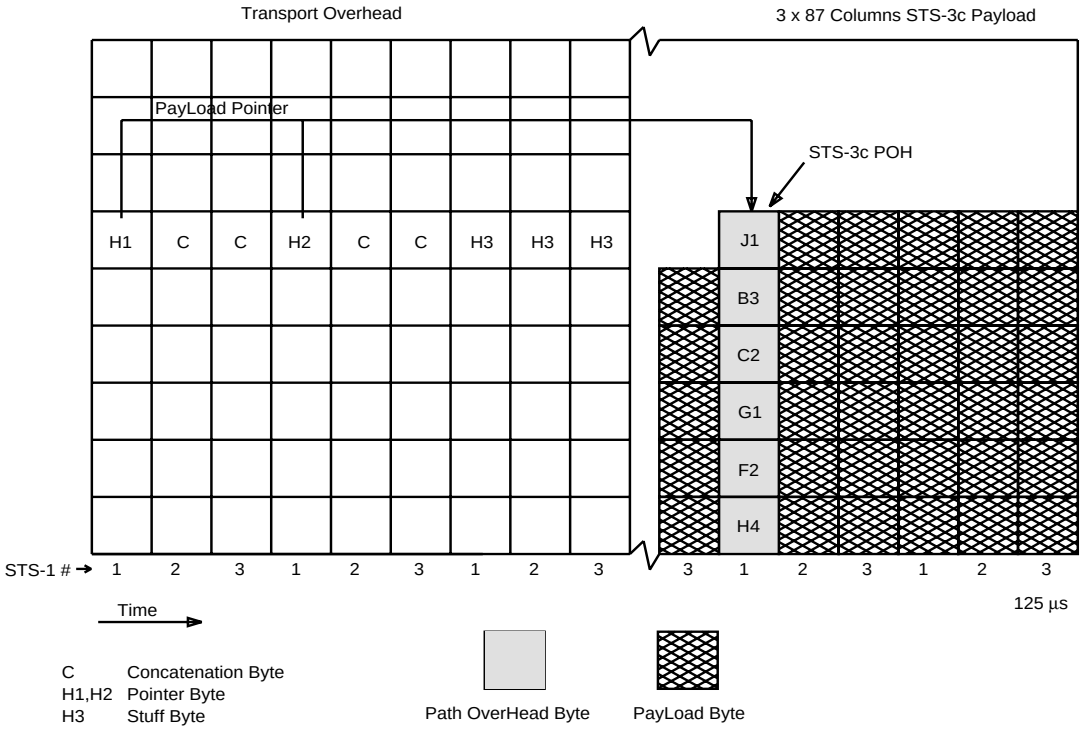
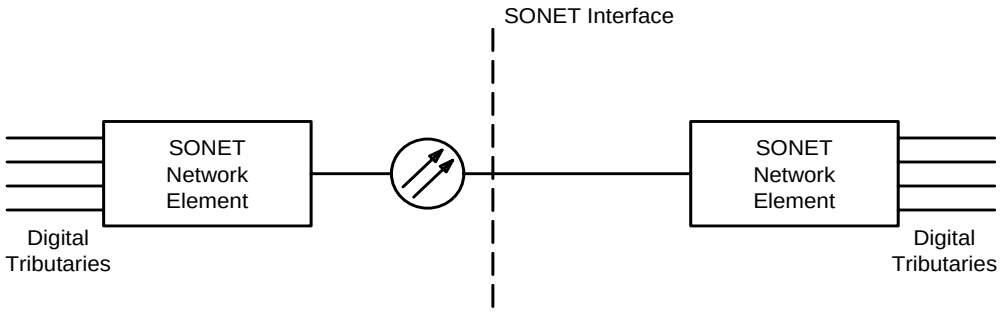


Figure A-10. STS-3c Concatenated Payload

SONET Interface

The SONET interface (Figure A-11) provides the optical midspan meet between SONET network elements. A SONET network element is the hardware and software that processes one or more layers of the SONET signal.



Standard optical interconnect at SONET interface

Family of standard rates at N X 51.84 Mb/s
[Synchronous Transport Signal (STS-1)]

Overhead channels defined for interoffice operations
and maintenance functions

Figure A-11. SONET Interface

SONET Payloads

Table A-1 shows the digital signals that can be transported as SONET payloads.

Table A-1. SONET Payloads

Input Tributary	Equivalent Channels	Rate	SONET Signal	Rate
DS1	24 DS0s	1.544 Mb/s	VT1.5	1.728 Mb/s
E1 (CEPT)	32 DS0s	2.048 Mb/s	VT2	2.304 Mb/s
DS1C	48 DS0s	3.152 Mb/s	VT3	3.456 Mb/s
DS2	96 DS0s	6.312 Mb/s	VT6	6.912 Mb/s
DS3	672 DS0s	44.736 Mb/s	STS-1	51.840 Mb/s
DS4NA	2016 DS0s	139.624 Mb/s	STS-3c	150.336Mb/s
ATM		149.76 Mb/s	STS-3c	150.336Mb/s
FDDI		125.00 Mb/s	STS-3c	150.336Mb/s
Future payloads		up to 150 Mb/s		
Future broadband payloads		Greater than 150 Mb/s		

DS1 and DS3 signals are the most important of these signals in the current network. Broadband payloads, such as asynchronous transfer mode (ATM) and fiber distributed data interface (FDDI), with rates of 150 Mb/s and higher, are also important. Other payloads may be defined for specific applications.

Higher Rate Transport

Higher rate SONET signals are created by byte-interleaving *N* STS-1 to form an STS-*N* signal. The STS-*N* is then scrambled and converted to an optical carrier - level *N* (OC-*N*) signal. The OC-*N* has a line rate of exactly *N* times the OC-1 signal (see Table A-2).

Table A-2. SONET Transport Rates

OC Level	Line Rate (Mb/s)	Capacity
OC-1	51.84	28 DS1s or 1 DS3
OC-3	155.52	84 DS1s or 3 DS3s
OC-9	466.56	252 DS1s or 9 DS3s
OC-12	622.08	336 DS1s or 12 DS3s
OC-18	933.122	504 DS1s or 18 DS3s
OC-24	1244.16	672 DS1s or 24 DS3s
OC-36	1866.24	1008 DS1s or 36 DS3s
OC-48	2488.32	1344 DS1s or 48 DS3s

Conclusion

The intent of this section is to present a short overview of SONET. More detailed expositions can be found in various literature. An excellent description of SONET can be found in Reference 3.

REFERENCES

1. ANSI T1.106-1988 •American National Standard for Telecommunications - Digital Hierarchy Optical Interface Specifications, Single Mode,• and ANSI T1.105-1991 •American National Standard for Telecommunications - Digital Hierarchy Optical Rates and Formats Specification.•
2. CCITT Recommendations G.707, G.708, G.709.
3. R. Ballert and Y. C. Ching, •SONET: Now It's the Standard Optical Network,• *IEEE Communications Magazine*, Vol. 27, No. 3 (March 1989): 8-15.
4. ANSI T1.102-1993 Draft •American National Standard for Telecommunications - Digital Hierarchy Electrical Interface Specifications.•

Glossary

0x1
: See Ring (0x1) Low Speed Interface.

1+1
: The 1+1 protection switching architecture protects against failures of the optical transmit/receive equipment and their connecting fiber facility. One bidirectional interface (two fibers plus associated OLIUs on each end) is designated "service," and the other is designated "protection." In each direction, identical signals are transmitted on the service and protection lines ("dual-fed"). The receiving equipment monitors the incoming service and protection lines independently, and selects traffic from one line (the "active" line) based on performance criteria and technician/OS control. In 1+1 both service and protection lines could be active at the same time (service in one direction—protection in the other).

1xN, 1x1
: 1xN protection switching pertains to circuit pack protection that provides a redundant signal path through the DDM-2000 (it does not cover protection switching of an optical facility; see "1+1"). In 1xN switching, a group of N service circuit packs share a single spare protection circuit pack. 1x1 is a special case of 1xN, with N=1. In 1x1 only one is active at a time.

A

ABN
: Abnormal (status condition)

ACO
: Alarm Cutoff — A pushbutton switch available on the user panel that can be used to retire an audible office alarm.

ACO/TST
: Alarm Cutoff and Test — The name of a pushbutton on the user panel.

Active
: Active identifies a 1+1 protected OC-N line which is currently selected by the receiver at either end as the payload carrying signal or a 1x1 or 1xn protected circuit pack that is currently carrying service. (See Standby.)

ADM
: Add/Drop Multiplexer.

AIS
: Alarm Indication Signal — A code transmitted downstream in a digital network that shows that an upstream failure has been detected and alarmed.

AMI
Alternate Mark Inversion — A line code that employs a ternary signal to convey binary digits, in which successive binary ones are represented by signal elements that are normally of alternating, positive and negative polarity but equal in amplitude, and in which binary zeros are represented by signal elements that have zero amplitude.

ANSI
American National Standards Institute

APS
Automatic Protection Switch

ARM
Access Resource Manager

AS&C
Alarm, Status, and Control

ASCII
American Standard Code for Information Interchange — A standard 8-bit code used for exchanging information among data processing systems and associated equipment.

ATM
Asynchronous Transfer Mode

Auto
Automatic — One possible state of a DS1 or DS3 port. In this state, the port will automatically be put "in service" if a good signal is detected coming from the DSX panel.

Automatic Protection Switch
A protection switch that occurs automatically in response to an automatically detected fault condition.

Automatic Synchronization Reconfiguration
A feature that allows another synchronization source to be automatically selected and the synchronization source provisioning to be automatically reconfigured in the event of a synchronization source failure or network synchronization change, for example, a fiber cut.

AUXCTL
Auxiliary Control — The name of the slot to the left of the SYSCTL slot on the DDM-2000 OC-3 and FiberReach wideband shelves and to the right of the SYSCTL slot on the DDM-2000 OC-12 shelf.

Available Time
In performance monitoring, the 1-second intervals.

B

B3ZS
Bipolar 3-Zero Substitution — A line coding method that replaces a string of three zeros with a sequence of symbols having some special characteristic.

B8ZS
Bipolar 8-Zero Substitution — A line coding method that replaces a string of eight zeros with a sequence of symbols having some special characteristic.

Backbone Ring
A host ring.

BDFB
Battery Distribution and Fuse Bay.

BER
Bit Error Ratio — The ratio of bits received in error to the total bits sent.

BIP
Bit Interleaved Parity — A method of error monitoring over a specified number of bits, that is, BIP-3 or BIP-8.

BITS
Building Integrated Timing Supply — A single clock that provides all the DS1 and DS0 synchronization references required by clocks in a building.

BRI
Basic Rate Interface

Broadband
Any communications channel with greater bandwidth than a voice channel; sometimes used synonymously with wideband.

C

CC
Clear Channel — A provisionable mode for the DS3 output that causes parity violations not to be monitored or corrected before the DS3 signal is encoded.

CCITT
International Telephone and Telegraph Consultative Committee — An international advisory committee under United Nations' sponsorship that has composed and recommended for adoption worldwide standards for international communications. Recently changed to the International Telecommunications Union Telecommunications Standards Sector (ITU-TSS).

CEV
Controlled Environment Vault

CD-ROM
Compact Disk, Read Only Memory

CDTU
Channel and Drop Test Unit

Channel
A logical signal within a port. For example, for an EC-1 port, there is one STS-1 channel and sometimes 28 VT1.5 channels. See Port.

Channel State Provisioning
A feature that allows a user to suppress reporting of alarms and events during provisioning by supporting multiple states (automatic, in-service and not monitored) for VT1.5 and STS-1 channels. See Port State Provisioning.

CIT
Craft Interface Terminal

CLF
Carrier Line Failure Status

CLK
Clock

CMISE
Common Management Information Service Element

CMOS
Complementary Metal Oxide Semiconductor

CO
Central Office

COACH
A system of on-line support tools aimed at providing product news and bulletins, diagnostic services, compatibility information, and on-line documents.

CP
Circuit Pack

CPE
Customer Premises Equipment

CR
Critical (alarm status)

CSA
Carrier Serving Area

CSU
Channel Service Unit

CS&O
Customer Support and Operations

CV
Coding Violation (a performance-monitoring parameter)

CVFE
Coding Violation Far-End — An indication returned to the transmitting terminal that an errored block has been detected at the receiving terminal.

D

DACS III-2000
Digital Access and Cross-Connect System that provides clear channel switching at either the DS3 or the STS-1 rates, eliminating the need for manual DSXs.

DACS IV-2000
Digital Access and Cross-Connect System that provides electronic DS3/STS-1 or DS1/VT1.5 cross-connect capability, eliminating the need for manual DSXs.

DCC
Data Communications Channel — The embedded overhead communications channel in the SONET line. It is used for end-to-end communications and maintenance. It carries alarm, control, and status information between network elements in a SONET network.

DCE
Data Communications Equipment — In a data station, the equipment that provides the signal conversion and coding between the data terminal equipment (DTE) and the line. The DCE may be separate equipment or an integral part of the DTE or of intermediate equipment. A DCE may perform other functions usually performed at the network end of the line.

DDM-1000
Lucent's Dual DS3 Multiplexer — A digital multiplexer that multiplexes DS1, DS1C, or DS2 signals into a DS3 signal or a 90 Mb/s or 180 Mb/s optical signal.

DDM-Plus
Lucent's optical and electrical DS1 transport system. DDM-Plus transports up to four DS1s per pair of optical fiber and can provide T1 extension over existing copper wires.

DDM-2000
Lucent's next generation network multiplexers that multiplex DS1, DS3, or EC-1 inputs into EC-1, OC-1, OC-3, or OC-12 outputs.

Default Provisioning
The parameter values that are preprogrammed as shipped from the factory.

Demultiplexing
A process applied to a multiplexed signal for recovering signals combined within it and for restoring the distinct individual channels of these signals.

DEMUX
Demultiplexer - "the DEMUX direction" is from the fiber toward the DSX.

Digital Multiplexer
Equipment that combines by time-division multiplexing several digital signals into a single composite digital signal.

DLC
Digital Loop Carrier

DPLL
Digital Phase-Locked Loop

DRI
Dual Ring Interworking. Two ring networks interconnected at two common nodes.

Drop and Continue
A technique that allows redundant signal appearances at two central offices in a DRI network, allowing protection against central office failures.

DS1
Digital Signal Level 1 (1.544 M/bs)

DS1 Circuit Pack
The DS1 interface circuit pack interfaces to the DSX-1 panel.

DS3
Digital Signal Level 3 (44.736 M/bs)

DS3 Circuit Pack
The DS3 circuit pack interfaces to the DSX-3 panel.

DSn
Digital Signal Rate n — One of the possible digital signal rates at DDM-2000 OC-3 and OC-12 interfaces: DS1 (1.544 Mb/s) or DS3 (44.736 Mb/s).

DSX
Digital Cross-Connect Panel — A panel designed to interconnect equipment that operates at a designated rate. For example, a DSX-3 interconnects equipment operating at the DS3 rate.

DT
Distant Terminal

DTE
Data Terminating Equipment — That part of a data station that serves as a data source (originates data for transmission), a data sink (accepts transmitted data), or both.

Dual 0x1 Cross-Connection
: In a single-homed application, the DDM-2000 OC-3/OC-12 Multiplexer uses a dual 0x1 cross-connection to map the VT1.5 channels between the DDM-2000 FiberReach OC-1 and the DDM-2000 OC-3/OC-12 rings. This dual 0x1 architecture means that the VT1.5 path switching is only in the DDM-2000 FiberReach and not in the host DDM-2000. Individual DS1 signals within an STS-1 can therefore be dropped to DDM-2000 OC-3 shelves at several nodes around the ring. See Single 0x1.

Dual Homing
: In DDM-2000 FiberReach, a network topology in which two OC-3 shelves serve as DDM-2000 FiberReach Multiplexer hosts supporting up to twelve OC-1 rings. Each DDM-2000 FiberReach Multiplexer ring is interconnected between the two separate hosts. Two *SLC*-2000 Access Systems serving as DDM-2000 FiberReach hosts can support up to four OC-1 rings. See Single Homing."

E

EC-1, EC-n
: Electrical Carrier — The basic logical building block signal with a rate of 51.840 Mb/s for an EC-1 signal and a rate of n times 51.840 Mb/s for an EC-n signal. An EC-1 signal can be built in two ways: A DS1 can be mapped into a VT1.5 signal and 28 VT1.5 signals multiplexed into an EC-1 (VT1.5 based EC-1), or a DS3 can be mapped directly into an EC-1 (DS3 based EC-1).

ECI
: Equipment Catalog Item — The bar code number on the faceplate of each circuit pack used by some inventory systems.

EEPROM
: Electrically Erasable Programmable Read-Only Memory

EIA
: Electronic Industries Association

EMC
: Electromagnetic Compatibility

EMI
: Electromagnetic Interference

EOOF
: Excessive Out of Frame

EPROM
: Erasable Programmable Read-Only Memory

EQ
: Equipped (memory administrative state)

ES
Errored Seconds — A performance monitoring parameter. ES "type A" is a second with exactly one error; ES "type B" is a second with more than one and less than the number of errors in a severely errored second for the given signal. ES by itself means the sum of the type A and type B ESs.

ESD
Electrostatic Discharge

ESF
Extended Super Frame (format for DS1 signal)

EST
Environmental Stress Testing

F

FCC
Federal Communications Commission

FDDI
Fiber Distribution Data Interface

FE
Far-End. Any other network element in a maintenance subnetwork other than the one the user is at or working on. Also called remote.

FE-ACTY
Far End Activity — An LED on the user panel.

FEBE
Far End Block Error — An indication returned to near-end transmitting node that an errored block has been detected at the far end.

FE ID
Far End Identification — The 7-segment display on the faceplate of the SYSCTL circuit pack.

FEPROM
Flash EPROM — A new technology that combines the nonvolatility of EPROM with the in-circuit reprogrammability of EEPROM (electrically-erasable PROM).

FERF
Far-End-Receive Failure — An indication returned to a transmitting terminal that the receiving terminal has detected an incoming section failure.

FE SEL
Far End Select — An LED on the user panel.

FIT
Failures in10^{-9} hours of operation.

Free Running
An operating condition of a clock in which its local oscillator is not locked to an internal synchronization reference and is using no storage techniques to sustain its accuracy.

FT-2000
Lucent's SONET OC-48 lightwave system.

Function Unit
Refers to any one of a number of different circuit packs that can reside in the A, B, or C function unit slots on the DDM-2000 OC-3 Multiplexer, or in the A, B, C, or D function unit slots of the DDM-2000 OC-12 Multiplexer.

G

GCNS-2000
Lucent's Gigabit Cell Network Switch.

GNE
Gateway Network Element — A network element that has an active X.25 link. Can also be a DSNE.

GR
Bellcore General Requirement

Group
The eight slots that may be equipped.

GTP
General Telemetry Processor

GUI
Graphical User Interface

H

Hairpin Routing
A cross-connection between Function Units. For example, Function Unit C to Function Units A or B. Cross-connections go through Main, but no bandwidth or time slots are taken from the backbone ring. Eliminates need for another shelf.

HECI
Humans Equipment Catalog Item

Holdover
An operating condition of a network element in which its local oscillator is not locked to any synchronization reference but is using storage techniques to maintain its accuracy with respect to the last known frequency comparison with a synchronization reference.

I

IAO LAN
IntrAOffice Local Area Network

IC
Internal Clock. Used in synchronization messaging.

ID
Identifier. See shelf ID and site ID.

IEC
International Electrotechnology Commission

IMF
Infant Mortality Factor

INC
Incoming Status

I/O
Input/Output

IP
Internet Protocol

IR
Intermediate Reach. A term used to describe distances of from 15 to 40 km between optical transmitter and receiver without regeneration. See long reach.

IS
In Service — One possible state of a DS1, DS3, or EC-1 port. Other possible states are "auto" (automatic) and "nmon" (not monitored).

ISCI
Intershelf Control Interface

ISI
Intershelf Interface

ISDN
Integrated Services Digital Network

IS-3
An intraoffice short reach proprietary interface provided by the 21D/21D-U and 22D-U optical line interface units.

ISO
International Standards Organization. See OSI.

IVHS
Intelligent Vehicle Highway System

J

Jitter
Timing jitter is defined as short-term variations of the significant instants of a digital signal from their ideal positions in time.

L

LAN
Local Area Network

LAPD
Link Access Procedure "D"

LBO
Line Build Out — An equalizer network between the DDM-2000 OC-3 and OC-12 Multiplexers and the DSX panel. It guarantees the proper signal level and shape at the DSX panel.

LCN
Local Communications Network

LEC
Local Exchange Carrier

LED
Light Emitting Diode — Used on a circuit pack faceplate to show failure (red) or service state. It is also used to show the alarm and status condition of the system.

Line Timing
The capability to directly derive clock timing from an incoming OC-N signal while providing the user the capability to provision whether switching to an alternate OC-N from a different source (as opposed to entering holdover) will occur if the OC-N currently used as the timing reference for that NE becomes unsuitable as a reference. For example, intermediate nodes in a linear network are line timed. See Loop Timing.

Local
See Near-End.

Locked Cross-Connection
This is a variation of the ring cross-connection that allows the user to lock the path selector to a specified rotation of the ring. Any signal received from the other rotation of the ring is ignored.

LOF
Loss of Frame — A failure to synchronize to an incoming signal.

Loop Timing
Loop timing is a special case of line timing. It applies to NEs that have only one OC-N interface. For example, terminating nodes in a linear network are loop timed. See Line Timing.

LOP
Loss of Pointer — A failure to extract good data from an STS-1 payload.

LOS
Loss of Signal — The complete absence of an incoming signal.

LR
Long Reach. A term used to describe distances of 40 km or more between optical transmitter and receiver without regeneration. See intermediate reach.

LS
Low Speed

M

Main
Slots on the DDM-2000 shelf in which the OLIU circuit packs are installed.

Midspan Meet
The capability to interface between two lightwave terminals of different vendors. This applies to high-speed optical interfaces.

MD
Mediation Device

MJ
Major Alarm

MM
Multimode

MML
huMan-Machine Language defined by ITU-TSS, formerly CCITT.

MN
Minor Alarm

MPEG
Moving Picture Experts Group

MSDT
Multi-Services Distant Terminal

MTBF
Mean Time Between Failures

MTBMA
Mean Time Between Maintenance Activities

Multiplexing
The process of combining several distinct digital signals into a single composite digital signal.

Mult
Multipling. The cascading of signals in a bay. In the MULT mode, the DS1 external reference can be cascaded to other shelves in a bay using Mult cables. Normally starting with the bottom shelf (Number 1) and working towards the top of the bay.

MUX
Multiplex

MXBIU
Multiplexer and Backplane Interface Unit

MXRVO Circuit Pack
The MXRVO circuit pack multiplexes seven VT-G signals from the DS1 circuit packs to an STS-1 signal for connection to the OLIU circuit packs.

N

NE
Near-End. The network element the user is at or working on. Also called local.

NE
Network Element — The basic building block of a telecommunications equipment within a telecommunication network that meets SONET standards. Typical internal attributes of a network element include: one or more high- and low-speed transmission ports, built-in intelligence, synchronization and timing capability, access interfaces for use by technicians and/or operation systems. In addition, a network element may also include a time slot interchanger.

NE-ACTY
Near End Activity — An LED on the user panel.

NEBS
Network Equipment-Building System

nm
Nanometer (10^{-9} meters)

NMA
Network Monitoring and Analysis — An operations system designed by Bellcore which is used to monitor network facilities.

NMON
Not Monitored — A provisioning state for equipment that is not monitored or alarmed.

Node
In SONET a node is a line terminating element.

Non-Revertive
A protection switching mode in which, after a protection switch occurs, the equipment remains in its current configuration after any failure conditions that caused a protection switch to occur clear or after any external switch commands are reset. (See Revertive.)

NRZ
Nonreturn to Zero

NSA
Not Service Affecting

NSAP
Network Services Access Point — An address that identifies a network element. Used for maintenance subnetwork communication using the OSI protocol.

NTF
No Trouble Found

O

OAM&P
Operations, Administration, Maintenance, and Provisioning

OC, OC-n
Optical Carrier — The optical signal that results from an optical conversion of an STS signal; that is, OC-1 from STS-1 and OC-n from STS-n.

OC-1
Optical Carrier Level 1 Signal (51.84 Mb/s)

OC-3
Optical Carrier Level 3 Signal (155 Mb/s)

OC-3c (STS-3c)
Optical Carrier Level 3 Concatenated Signal — Low-speed broadband signal equivalent to three STS-1s linked together with a single path overhead.

OC-12
Optical Carrier Level 12 Signal (622 Mb/s)

OHCTL
The overhead controller circuit pack provides user access to the SONET overhead channels.

OLIU
Optical Line Interface Unit

OOF
Out of Frame

OOL
Out of Lock

Operations Interface
Any interface that provides information on the system performance or control. These include the equipment LEDs, user panel, CIT, office alarms, and all telemetry interfaces.

OPS/INE
Operations System/Intelligent Network Element

OS
Operations System — A central computer-based system used to provide operations, administration, and maintenance functions.

OS-GNE
Operations System - Gateway Network Element

OSI
Open Systems Interconnection — Referring to the OSI reference model, a logical structure for network operations standardized by the International Standards Organization (ISO).

OSGNE
Operations System Gateway Network Element — An OSGNE serves as a single interface to the OS for NEs in the same subnetwork using X.25 interfaces.

OSMINE
Operations Systems Modifications for the Integration of Network Elements.

OSP
Outside Plant

P

Pass Through
Paths that are cross-connected directly across an intermediate node in a ring network.

P-bit
Performance Bit

PC
Personal Computer

PCU
Power Conversion Unit

PID
Program Identification

PINFET
Positive Intrinsic Negative Field Effect Transistor

PJC
Pointer Justification Count

Plesiochronous Network
: A network that contains multiple maintenance subnetworks, each internally synchronous and all operating at the same nominal frequency, but whose timing may be slightly different at any particular instant. For example in SONET networks, each timing traceable to their own Stratum 1 clock are considered plesiochronous with respect to each other.

PLL
: Phased-Locked Loop

PM
: Performance Monitoring — Measures the quality of service and identifies degrading or marginally operating systems (before an alarm would be generated).

PMN
: Power Minor Alarm

POH
: Path Overhead

POP
: Points of Presence

Port
: The physical, electrical, or optical interface on a system. For example, DS1, DS3, EC-1, OC-3, and OC-12. See Channel.

Port State Provisioning
: A feature that allows a user to suppress alarm reporting and performance monitoring during provisioning by supporting multiple states (automatic, in-service and not monitored) for low speed ports. See Channel State Provisioning.

POTS
: Plain Old Telephone Service

Proactive Maintenance
: Refers to the process of detecting degrading conditions not severe enough to initiate protection switching or alarming, but indicative of an impending signal fail or signal degrade defect (for example, performance monitoring).

Protection Line
: As defined by the SONET standard, the protection line is the pair of fibers (one transmit and one receive) that carry the SONET APS channel (K1 and K2 bytes in the SONET line overhead). On a DDM-2000 OC-3 system, a *protection* line is a pair of fibers that terminate on an OLIU circuit pack in the `main-2`, `fn-a-2`, `fn-b-2`, or `fn-c-2` slot. (See "Service Line.")

PRM
: Performance Report Message

PROTN
: Protection

Product Family 2000
Lucent's line of SONET standard network products providing total network solutions.

PRS
Primary Reference Source

PSU
Power Supply Unit

PVC
Permanent Virtual Circuit

PWR
Power

R

RAM
Random Access Memory

Reactive Maintenance
Refers to detecting defects/failures and clearing them.

Remote
See Far-End (FE)

Revertive
A protection switching mode in which, after a protection switch occurs, the equipment returns to the nominal configuration (that is, the service equipment is active, and the protection equipment is standby) after any failure conditions that caused a protection switch to occur clear or after any external switch commands are reset. (See "Non-Revertive.")

Ring
A configuration of nodes comprised of network elements connected in a circular fashion. Under normal conditions, each node is interconnected with its neighbor and includes capacity for transmission in either direction between adjacent nodes. Path switched rings use a head-end bridge and tail-end switch. Line switched rings actively reroute traffic over a protection line. Ring (0x1) Low Speed Interface

Formerly referred to as dual 0x1 or single 0x1. In ring applications, the DDM-2000 OC-3 and OC-12 Multiplexers use a 0x1 interface meaning both fibers carry service as opposed to a linear (1+1) low speed interface where one fiber is used for service and the other for protection. See 1+1.

RPP
Reliability Prediction Procedure — Described in Bellcore TR-NWT-00032.

RT
Remote Terminal — An unstaffed equipment enclosure that may have a controlled or uncontrolled environment.

RTAC
Lucent Regional Technical Assistance Center (1-800-225-RTAC)

RZ
Return to Zero

S

SA
Service Affecting

SCADA
Supervisory Control and Data Acquisition

SD
Signal Degrade

SDH
Synchronous Digital Hierarchy

Self-Healing
Ring architecture in which two or more fibers are used to provide route diversity. Node failures only affect traffic dropped at the failed node.

SEFS
Severely Errored Frame Seconds

SEO
Single-Ended Operations — The maintenance capability that provides remote access to all DDM-2000 systems from a single location over the DCC.

Service Line
On a DDM-2000 system, a service (or "working") line is a pair of fibers (one transmit and one receive) that terminate on an OLIU circuit pack in the `main-1`, or `fn-a-1`, or `fn-b-1`, or `fn-c-1` slot. As defined by the SONET standard, the SONET APS channel is not defined on a service (or "working") line. (See "Protection Line.")

SES
Severely Errored Seconds — This performance monitoring parameter is a second in which a signal failure occurs, or more than a preset amount of coding violations (dependent on the type of signal) occurs.

SF
Super Frame (format for DS1 signal)

Shelf ID
A switch settable parameter with values of from 1 to 8. Used to log into a selected shelf in a bay using the CIT.

SID
System Identification

Single 0x1 Cross-Connection
: In a dual-homed application, the DDM-2000 OC-3/OC-12 Multiplexer uses a single 0x1 cross-connection to map the VT1.5 channels between the DDM-2000 FiberReach OC-1 and the DDM-2000 OC-3/OC-12 rings. This single 0x1 architecture maps low speed to high speed on a specified ring rotation. The high speed to low speed drop is made on the same specified ring with no path switching. Protection is provided at the VT1.5 end points. See Dual 0x1.

Single Homing
: In DDM-2000 FiberReach, a network topology in which a single OC-3 shelf serves as a DDM-2000 FiberReach Multiplexer host supporting up to six OC-1 rings. A *SLC*-2000 Access System serving as a host can support up to two OC-1 rings. See Dual Homing.

Site ID
: A switch settable parameter with values of from 1 to 8. Displayed on SYSCTL circuit pack to indicate to which site the user panel alarms and LEDs apply.

SLIM
: Subscriber Loop Interface Module

SM
: Single Mode

SONET
: Synchronous Optical NETwork

SPE
: Synchronous Payload Envelope

SQU
: Sync Quality Unknown. Used in synchronization messaging.

SRD
: Software Release Description

Standby
: Standby identifies a 1+1 protected OC-N line which is not currently selected by the receiver at either end as the payload carrying signal, or a 1x1 or 1xn protected circuit pack that is not currently carrying service. (See Active.)

Star Topology
: For DDM-2000 FiberReach, this refers to a configuration of multiple point-to-point OC-1 extensions from a single DDM-2000 OC-3/OC-12 Multiplexer.

Status
: The indication of a short-term change in the system.

STS, STS-n
: Synchronous Transport Signal — The basic logical building block signal with a rate of 51.840 Mb/s for an STS-1 signal and a rate of n times 51.840 Mb/s for an STS-n signal.

STS-1 SPE
: STS-1 Synchronous Payload Envelope — A 125-microsecond frame structure composed of STS path overhead and the STS-1 payload.

STS-3c
: Synchronous Transport Level 3 Concatenated Signal. See OC-3c.

Subnetwork
: Group of SONET network elements that share a SONET data communications channel.

Synchronization Messaging
: SONET synchronization messaging is used to communicate the quality of network timing, internal timing status, and timing states throughout a subnetwork.

SYSCTL
: The system controller circuit pack that provides overall administrative control of the terminal.

T

T1EXT
: T1 Carrier Extension Circuit Pack

T1X1 and T1M1
: The ANSI committees responsible for telecommunications standards.

TA
: Bellcore Technical Advisory

TARP
: Target ID Address Resolution Protocol

TCA
: Threshold-Crossing Alert — A condition set when a performance-monitoring counter exceeds a user-selected threshold. A TCA does not generate an alarm but is available on demand through the CIT and is shown by TBOS and causes a message to be sent to NMA via the X.25/TL1 interface.

TCVCXO
: Temperature-Compensated Voltage-Controlled Crystal Oscillator — A highly stable and accurate clock source used in the DDM-2000 TGS circuit pack.

TGS
: The timing generator circuit pack generates clock signals for distribution to the transmit circuits. It operates in the free-running, loop-timing, phase-lock, and holdover modes.

TID
: Target Identifier — The Bellcore name for the system name.

TL1
Transaction Language 1 — A Bellcore machine-to-machine communications language that is a subset of ITU-TSS, formerly CCITT's, human-machine language.

TLB
Timing Looped Back. Used in synchronization messaging.

TOP
Task Oriented Practice

TR
Bellcore Technical Requirement

TSA
Time Slot Assignment

TSI
Time Slot Interchange

TSO
Technical Support Organization — Supports RTAC and the customers.

U

UAS
Unavailable Seconds. In performance monitoring, the count of seconds in which a signal is declared failed or, in which, 10 consecutively severely errored seconds (SES) occurred, until the time when 10 consecutive non-SES occur.

Unidirectional
A protection switching mode in which the system at each end of an optical span monitors both service and protection lines and independently chooses the best signal (unless overridden by an equipment failure or by an external request, such as a forced switch or lockout). In a system that uses unidirectional line switching, both the *service* and *protection* lines may be *active* simultaneously, with one line carrying traffic in one direction and the other line carrying traffic in the other direction. For a 1+1 protection scheme the K1 and K2 bytes in the SONET line overhead are used to convey to the far end which line the near end receiver has chosen, so that an "active" indication may be made at the far end.

UOC
Universal Optical Connector — Receptacles on the faceplate of some OLIUs that accept *ST*®, SC, or FC connectors.

UPD/INIT
A pushbutton on the user panel.

V

VF
Voice Frequency

VLSI
Very Large Scale Integration — Refers to very complex state of the art integrated circuits.

VM
Violation Monitor — A mode of the DS3 circuit pack in which it will monitor but not remove P-bit parity violations on the DS3 signal received from the fiber.

VMR
Violation, Monitor, and Removal — A mode of the DS3 circuit pack in which it will monitor and remove P-bit parity violations on the DS3 signal received from the fiber.

VONU
Virtual Optical Network Unit

VT
Virtual Tributary — A structure designed for transport and switching of a sub-DS3 payload.

VT1.5
A 1.728 Mb/s virtual tributary

VT-G
Virtual Tributary Group — A 9-row by 12-column SONET structure (108 bytes) that carries one or more VTs of the same size. Seven VT groups (756 bytes) are byte-interleaved within the VT-organized STS-1 synchronous payload envelope.

W

WAN
Wide Area Network

Z

Zero Code Suppression
A technique used to reduce the number of consecutive zeros in a line-codes signal (B3ZS for DS3 signals and B8ZS for DS1 signals).

Index

Numerics

177B Apparatus Blank, 7-76
177C Apparatus Blank, 7-77

A

ABN LED, 6-10
Access
  Front, OC-12, 3-2
Access Network Timing Distribution, 5-32
ACO Indicator, 10-29
ACO LED, 6-10
ACO/TST Pushbutton, 6-10
ACTIVE Indicator, 10-30
ACTIVE Indicators, 6-12
ACTIVE LED on Rings, 9-26
Administration
  Security, 8-2
  Software Upgrades, 8-4
  Version Recognition, 8-1
AIS, 9-16
AIS Signals, 9-10
Alarm, 6-10
  Delay, 6-13
  Power Minor, 4-4
Alarm Indication Signal, 9-10
Alarms
  Office, 6-13
Apparatus Blank
  177B, 7-76
  177C, 7-77
Applications
  Broadband Business Access, 2-30
  Intelligent Vehicle Highway System, 2-38
  Interoffice Transport, 2-29
  Locked STS-3c Broadband Services, 2-34
  Loop Feeder, 2-29
  Teleprotection and SCADA Applications, 2-36
Attenuators
  Universal Buildout, 10-21
  Universal Optical Connector, 10-21
Automatic Synchronization Reconfiguration, 5-19
Availability
  Operation System Interface, 10-39

B

Backup and Restoral, 8-6
Baffle, 3-7
Brownout Protection, 7-9
Brownout Protection, BBG8 SYSCTL, 1-7

C

Cable
  Dangler, 3-20
Canadian Standards Association, 10-35
Centralized Survivable OS Access (OSGNE), 8-14
Channel State Provisioning, 8-13
Circuit Breakers
  Fan, 3-21
Circuit Packs
  177B APPBLK, 7-76
  177C APPBLK, 7-77
  21D/21D-U OLIU, 7-51
  21G/21G-U OLIU, 7-56
  23G/23G-U OLIU, 7-64
  23H/23H-U OLIU, 7-70
  Automatic Provisioning, 8-9
  BBF2B TGS Timing Generator, 7-18
  BBG11 3DS3, 7-25
  BBG11B 3DS3, 7-32
  BBG12 3STS1E, 7-40
  BBG8 SYSCTL, 7-5
  BCP3 TSI FLEX, 7-46
  BCP4 OHCTL, 7-12
  Control, 7-4
  Faceplate Indicators, 6-8
  Keying, OC-12, 3-5
  Universal Optical Connector, 7-2
CIT
  Compatible Modems, 10-28
  Local Access, 6-4
  Modem Access, 6-6
  Modem Port, 6-2
  PC as a CIT, 6-6
  Remote Access Using DCC, 6-7
  Terminals, 6-2
CIT Interfaces, 6-4
CIT Selectable Parameters, 8-39
Clear Delay, 6-13
Comments
  Document, lxx
Configurations
  2000 Product Family Interworking, 2-26
  Dual Homing, 2-15
  Folded Ring, 2-13

FT-2000 OC-48 Lightwave System, 2-27
Multivendor Applications, 2-28
OC-12 Path Switched Rings, 2-6
OC-12 Point-to-Point, 2-24
OC-12 STS-1/VT1.5 Path Switched Ring (0x1) , 2-12
OC-3 Linear Optical Extensions from OC-3 and OC-12 Rings, 2-22
OC-3 Ring Transport on OC-12 Point-to-Point, 2-14
Operations Interworking, 2-27
Path Switched Rings, 2-3
SLC-2000 Access System, 2-26
Synchronization, 7-16
configurations
Dual Ring Interworking, 2-15
Controller Maintenance and Memory Administration, 8-4
Courses
Training, lix
CPro-2000 Graphical User Interface and Provisioning Tool, 6-8, 10-29
Craft Interface Terminal, 10-26
Craft Interface Terminals, 6-2
Cross-Connection Provisioning, 8-15
Cross-Connections
Drop and Continue, 8-15
Manual OC-12 Ring, 8-16
Pass Through, 8-16
Ring (0x1), 8-15
Video, 8-15

D

Dangler Cable, 3-20
DCC
Remote Access Using DCC, 6-7
DCC Provisioning, 8-10
Delay, 10-24
Alarm, 6-13
Directory Services Network Element (DSNE), 9-43
Discretes
Miscellaneous, 6-16
Document Comments, lxx
Documentation
Electronic, lxx
Related, lii
Documentation Support, lxvii
Documents
Ordering Documents, lxviii
Drawings
DDM-2000 OC-12, lvi
DDM-2000 OC-3, lvi
DS1 Outputs, 7-21
DS1 Timing Output, 7-18
DS3 Performance Monitoring, 9-29
C-Bit, 9-29
F&M-Bit, 9-29
P-Bit, 9-29
Dual Homed OC-3/OC-12 VT1.5 Path Switched Ring (0x1), 8-34
Dual Ring Interworking, 5-4
Path Protection Scheme, 9-24
Software Compatibility, 9-9
Dual Wire Center, 8-16

E

Earthquake Requirements, 10-34
Electrostatic Discharge, xlvii
EMC Requirements, 10-34
Environmental Alarms, 6-16
Environmental Controls, 6-16
Environmental Specifications
1550 nm Systems, 10-34
Equipment Indicators, 6-12, 10-30
ESD Considerations, xlvii
External Optical Attenuator
23G/23G-U OLIU, 7-65
External Optical Attenuators
23H/23H-U OLIU, 7-71
External Transmission Interfaces Standards, 10-1

F

Faceplate Indicators, 6-8
Fan Circuit Breakers, 3-21
Fan Filters, 3-20
Fan Shelf, 3-18
Physical Characteristics, 10-33
Fan Shelf Switch Settings, 3-19
FAULT Indicator, 10-30
FAULT Indicators, 6-12
FAULT LEDs, 4-4
FE ACTY LED, 6-10
FE SEL Pushbutton, 6-10
Feature Package Provisioning, 8-10
FERF, 9-16
FERF Signals, 9-10
Filters
Fan, 3-20
Fire Resistance, 10-35
Fuses, 4-2
Shelf, 10-35

G

Gateway Network Elements (GNEs)
Multiple, 8-14
Grounding Jacks, xlix

H

Holdoff Delay, 6-13
Holdover, 5-11, 7-20

I

Identifiers
  AGNE, 8-43
  CO/RT, 8-43
  DSNE, 8-43
  Network Element ID, 8-43
  NSAP, 8-43
  OSGNE, 8-43
  Shelf ID, 8-43
  Site ID, 8-43
  Target ID, 8-43
Indicators
  ACTIVE, 6-12
  Equipment, 6-12, 10-30
  Faceplate, 6-8
  FAULT, 6-12
Infant Mortality, 10-39
Inservice Upgrades, 9-8
Instructions
  Safety, xliii
Interfaces
  Craft Interface Terminal, 10-26
  Office Alarms, 10-30
  Operations, 10-26
  Technician, 6-2
Interoffice Timing Distribution, 5-30

L

Laser Classifications, xliv
  Class I, xliv
Lasers and Eye Damage, xliv
LEDs
  CONTROL FAULT, 3-21
  FAN FAULT, 3-21
  FILTER REPLACE, 3-21
  POWER FAULT, 3-21
  POWER ON, 3-21
  User Panel, 6-10
Lightguide Jumpers, 10-6
Lightwave Safety Guidelines, xliii
Lightwave Safety Precautions, xlv
Line State Provisioning, 8-14
Loopbacks
  DS3, 9-26
  EC-1, 9-26
  Optical, 9-26
Lucent 2000 Product Family, 1-1

M

Maintenance
  Automatic Diagnostics, 9-16
  Proactive, 9-27
  Protection Switching, 9-17
  Signaling, 9-10
  Single-Ended Maintenance Philosophy, 9-4
  Subnetwork, 9-4
  Three-tiered Operations, 9-1
Memory Administration, 8-5
Messages
  TL1, 6-14
Miscellaneous Discretes
  User-Definable, 6-16, 10-30
Mixing
  OC-3 Optical Interface, 10-17
Modem, 6-2
  Baud Rates, 6-6
Modem Access, 6-6
Modem Port
  CIT, 6-2
Modems
  Compatible, 6-7, 10-28
Mounting
  Network Bay and Cabinet Mounting, 10-33
Multiplexing and Mapping, 8-7
  DS3 to OC-12, 8-7
  EC-1 to OC-12, 8-8
  OC-3 to OC-12, 8-7
  OC-3c to OC-12, 8-8

N

National Product Training Center, lix
NE ACTY LED, 6-10
Neighbors, 8-20, 8-25
Network Bay and Cabinet Mounting, 10-33
Network Monitoring and Analysis, 6-14
Network Timing Distribution, 5-30
NMA, 6-14
NSAP, 8-10

O

OC-12 Rings
  Ring Network Cross-Connection Example, 8-21
OC-12 STS-1 Path Switched Ring, 5-2
Office Alarms, 6-13
Office Alarms Interfaces, 10-30
Open Systems Interconnection Provisioning, 8-11
Operations Interface Tests, 9-27
Operations Interworking
  Remote Login, 8-14
  Remote Software Download and Copy, 8-4, 8-14
  Restrictions, 8-14
Operations System/Intelligent Network Element, 6-14
OPS/INE, 6-14
Optical Faceplate Latch, BBG8 SYSCTL, 1-7, 7-6
Optical Interface
  OC-3 Mixing, 10-17
Overhead Bytes
  SONET, 10-22

P

Panel
  User, 10-29
Panel, Front, OC-12, 3-6
Parameters
  CIT Selectable, 8-39
  Switch Selectable, 8-38
Path Protection Switching (Path Switched Rings), 9-21
PC as a CIT, 6-6
Performance
  Signal, 10-22
  Transient, 10-24
  Wander/Jitter, 10-22
Performance Monitoring, 9-27
  Adjusted F&M Bit, 9-29
  Data Storage and Reports, 9-40
  DS1/DS3 Line and Path and DS3 Path, 9-28
  DS3, 9-29
  DS3 Line, 9-30
  DS3 Line Parameters, 9-40
  DS3 Path Parameters, 9-37
  During Failed Conditions, 9-40
  EC-1 Line Parameters, 9-35
  OC-3 and OC-12 Line Parameters, 9-34
  OC-3 and OC-12 Section Parameters, 9-33
  Optical Parameters, 9-33
  Optical Transmit Power, 9-33
  Parameter Thresholds, 9-40
  Performance Status Report, 9-41
  Reports, 9-41
  STS-1 Path Parameters, 9-36
  TCA Summary Report, 9-41
  TCA Transmission to OS, 9-41
Personal Computer for Software Download
  Specifications, 10-27
PMN LED, 4-4
Port State Provisioning, 8-13
Power
  23G/23G-U and 23H/23H-U OLIU Circuit Packs, 4-3
  Description, 4-2
  Distribution, 4-5
  OHCTL Circuit Pack, 4-3
  SYSCTL Circuit Pack, 4-3
  TSI, TGS, 3DS3, and 3STS1E Circuit Packs, 4-3
Power Dissipation, 10-36
Power Loss Restart, 10-24
Power Minor Alarm, 4-4
Primary Reference Source (PRS), 5-14
Proactive Maintenance, 9-27
Protection Switching, 9-17, 9-20, 10-23
  Ring Networks, 10-23
  Synchronization Reference, 9-20
Provisioning, 8-9
  Automatic Provisioning on Circuit Pack Replacement, 8-9
  Channel State, 8-13
  Cross-Connection, 8-15
  DCC Provisioning, 8-10
  Default Provisioning, 8-9
  Dual Homed OC-3/OC-12 VT1.5 Path Switched Ring (0x1), 8-34
  Feature Package, 8-10
  Line State, 8-14
  OC-12 Path Protected Ring Application, 8-20
  OC-12 Path Protected Ring Drop and Continue Application, 8-20
  OSI, 8-11
  Port State, 8-13
  Remote Provisioning, 8-9
  Reports, 9-42
  Ring Drop and Continue Cross-Connection Application, 8-25
  Single Homed OC-3/OC-12 VT1.5 Path Switched Ring (0x1), 8-30
  Video Applications, 8-20
Provisioning Tool, SNC-2000 CPro, 6-8, 10-29
Pushbutton
  ACO/TST, 6-10
  ALARM RESET, 3-21
  ALARM TEST, 3-21
  Combinations, 6-11
  Fan, 3-21
  FE SEL, 6-10
  UPD/INIT, 6-11
PWR ON Indicator, 10-29

PWR ON LED, 6-10
PWR ON LEDs, 4-4

R

Related Training, lix
Releases
  DDM-2000 OC-12 Multiplexer, 1-3, 1-8
Reliability, 10-38
Reliability Predictions, 10-40
Reports
  Alarm and Statuses, 9-42
  Database Change Transmission to OS, 9-42
  Equipment, 9-43
  Maintenance History, 9-42
  Network Map, 9-43
  Provisioning, 9-42
  State Reports, 9-43
Requirements
  Earthquake, 10-34
  EMC, 10-34
  Power, 10-35
Restart
  Power Loss, 10-24
RIDES, 6-14
Ring
  Path Protection Scheme, 9-22
Rings
  ACTIVE LED on, 9-26
  DRI Path Protection Scheme, 9-24
  Linear (1+1) Optical Extension Between OC-12 and OC-3, 5-8
  OC-3/OC-12 (0x1) Low-Speed Interfaces, 5-4
  Path Protection Switching, 9-21
  Synchronization Reconfiguration in an Access Ring, 5-27

S

Safety
  Cautions, xliii
  Dangers, xliii
  Instructions, xliii
  Labels, xliii
  Lasers and Eye Damage, xliv
  Lightwave Safety Guidelines, xliii
  Warnings, xliii
Safety Instructions, l
Security
  Administration, 8-2
Service Affecting Actions, 8-6
Shelf
  Configurations, 3-7
  EMC Requirements, 3-6
  Fan, 3-18
  Fuses, 4-2
  Linear (1+1) Extension From OC-12 Ring Configuration, 3-14
  OC-12 Circuit Pack Keying, 3-5
  OC-12 Dual Homing, 3-15
  OC-12 Front Access, 3-2
  OC-12 Front Panel, 3-6
  OC-12 Multiplexer, 3-1
  OC-12 Optical Extension, 3-13
  OC-12 Rear Access, 3-2
  OC-12 Ring (DS1/EC-1 Low-Speed Interfaces), 3-12
  OC-12 STS-1 Path Switched Ring, 3-9
  OC-12 STS-1/VT1.5 Path Switched Ring Configuration , 3-10
  OC-3/IS-3 Dual Ring Interworking Configuration, 3-11
  OC-3c Transport, 3-17
  STS-3c Broadcast, 3-16
Shelf Fuses, 10-35
Signal Performance, 10-22
Signaling
  Maintenance, 9-10
Signals
  AIS, 9-10
  Alarm Indication, 9-10
  FERF, 9-10
  Yellow, 9-10
Single Homed OC-3/OC-12 VT1.5 Path Switched Ring (0x1), 8-30
Software
  Compatibility, 8-4
Software Compatibility, 8-4
  DRI, 9-9
Software Compatibility, OC-3 and OC-12, 9-9
SONET
  Concatenated Mode, A-16
  Frame Structure, A-6
  History, A-1
  Interface, A-17
  Layers, A-4
  Multiplexing Procedures, A-14
  Purpose, A-2
  Section Orderwire, A-6
  Section Overhead, A-6
Specifications
  Personal Computer for Software Download, 10-27
  Physical, 10-33
  Timing Modes, 10-23
Subnetwork, Maintenance, 9-4
Support
  COACH, lxiii
  Customer Support and Operations, lxvi
  Documentation, lxvii
  Electronic Documentation, lxx

Engineering and Installation Services, lxvi
Ordering Documents, lxviii
Technical, lxii
Training, lix
Transmission Systems Technical Support Services, lxvii
Switch Selectable Parameters, 8-38
Switch Settings
21G/21G-U OLIU Circuit Pack, 7-61
BBG11 3DS3 Circuit Pack, 7-30
BBG11B 3DS3 Circuit Pack, 7-37
BBG12 3STS1E Circuit Pack, 7-44
TGS Circuit Pack, 7-22
Switch Settings, BBG8 SYSCTL Circuit Pack, 7-10
Switching
Equipment Protection, 9-20
Protection, 9-17, 10-23
Synchronization
Access Network Timing Distribution, 5-32
Circuit Pack, 7-18
DS1 External, 5-10
DS1 Reference Cascading (MULT Mode), 5-11
Holdover, 5-11
Inter Office Timing Distribution, 5-30
Interfaces, 5-10
Network Timing Distribution, 5-30
Reconfiguration in an Access Ring, 5-27
Technical Specifications, 10-22
Synchronization Messaging, 5-16
Synchronization Reference Protection, 9-20
Automatic Synchronization Reconfiguration, 9-20
Holdover, 9-20
Revertive and Nonrevertive Timing Mode Switching, 9-20
Synchronization Messaging, 9-20

T

Tariff Verification, 9-28
Technical Specifications
DS3 Low Speed (BBG11/11B 3DS3), 10-2
EC-1 Low-Speed (BBG12 3STS1E), 10-5
IS-3 Interface (21D/21D-U OLIU), 10-8
Long Reach 1310 nm OC-12 Interface (23G/23G-U OLIU), 10-13
Long Reach 1550 nm OC-12 Interface (23H/23H-U OLIU), 10-13
Long Reach OC-3 Interface (21G/21G-U OLIU), 10-7
Optical Interfaces, 10-6
Synchronization, 10-22
Tests
Automated Installation, 9-27
Operations Interface, 9-27
Test Signal Generators, 9-27
Transmission, 9-27
Threshold Crossing Alert (TCA), 9-41
TIDs, 9-43
Timing Modes
DS1 Reference Cascading (MULT Mode), 5-11
DS1 Synchronization Output, 5-11
External, 5-10
External Timing, 7-18
Free-Running, 5-10, 7-18
Line, 5-10
Line (formerly loop) Timing, 7-18
Timing Output
DS1, 7-18
TL1 Messages, 6-14
TL1/X.25 Interface, 6-14, 10-31
Training
Courses, lix
Related, lix
Transmission Availability, 10-38
Transmission Interfaces
External Standards, 10-1

U

Underwriters Laboratories, 10-35
Universal Buildout Attenuators, 10-21
Universal Optical Connector, 7-2
Universal Optical Connector Attenuators, 10-21
UPD/INIT Pushbutton, 6-11
Upgrades
Inservice, 9-8
Software, 8-4, 9-8
User Panel, 6-8, 10-29
LEDs, 6-10
User Panel and Faceplate Interfaces, 6-8
User-Definable Miscellaneous Discretes, 10-30

W

Wrist Strap, xlix

X

X.25 Interface, 6-14

Y

Yellow Signals, 9-10